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# The Journal

OF

# Nervous and Mental Disease

AN AMERICAN JOURNAL OF NEUROLOGY AND PSYCHIATRY

FOUNDED IN 1874

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Presenting Reports of the

AMERICAN NEUROLOGICAL ASSOCIATION, AMERICAN MEDICO-PSYCHOLOGICAL SOCIETY, NEW YORK NEUROLOGICAL SOCIETY, NEW YORK PSYCHIATRICAL SOCIETY, BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY, PHILADELPHIA NEUROLOGICAL SOCIETY, ETC.

VOL. 48. 1918

NEW YORK

64 WEST 56TH STREET

1918

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*19/6/19*

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PRESS OF  
THE NEW ERA PRINTING COMPANY  
LANCASTER, PA.

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## Original Articles

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### CERTAIN PLURIGLANDULAR ANOMALOUS FUNCTIONS ASSOCIATED WITH PSYCHOPATHIC SEXUAL INTERESTS\*

BY MARY O'MALLEY

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The problem as to what endocrine functions are disharmonized in the anomalous biological condition known as pseudohermaphroditism, whether of the somatic or psychic type or a combination of both, has not, as yet, been solved. The weight of evidence furnished by observations and investigations both clinical and experimental, made in the various chemical and physiological laboratories, tends to show that there is an interrelation of physiological functioning in the pluriglandular system; that the hormone of any one of these glands bears a specific relation to each and every other endocrine gland; and that there are definite syndromes which have come to be recognized as due to physiological or pathological changes producing a hyperfunction, a hypofunction, or a dysfunction of these glands.

The secondary sex characters are known to have dependence upon the development and maturation of the gonads, and the presence of abnormalities of the sex attributes, whether in the domain of the generative organs or the secondary sex qualities is, therefore, evidence of a disturbance of functioning of these glands, hence of the endocrine system.

Our knowledge of the endocrine organs began with experiments

\* This paper was read before the Medical Society of the District of Columbia, May 23, 1917.

on the sex glands. From earliest antiquity it has been recognized that the removal of these glands previous to pubescence produced marked changes in the development and configuration of the body as well as in the psychic qualities. Yet, it is only within recent years that real scientific application has been made of that knowledge in the great unexplored field of the internal secretions. Thomas Addison was practically the pioneer in the clinical work in diseases of the ductless glands. The classical disease picture which bears his name is due to a pathological condition of the suprarenals. Later followed the discoveries of Kocher, Reverdin and others, that myxedema was due to diminution in the activity of the thyroid gland. Brown-Séquard, after the subcutaneous injections of testicular tissue into his own body, experienced an increase of bodily and mental powers which he attributed to its influence. Pierre Marie was one of the first to recognize the hyperfunctioning of the hypophysis in acromegaly; and later A. Fröhlich described a syndrome of hypophyseal dystrophy which he, together with v. Frankel-Hochwart, observed in the latter's clinic, due to hypofunctioning of this gland. The discovery of pancreatic diabetes and Minkowski's reference to its physiological relation to the insular apparatus of the pancreas increased the knowledge in the field of the pluriglandular system. Furthermore, the relation of cretinism and tetany to the thyroid and parathyroid has thrown more and more light into this unknown sphere. Persistent research has failed to yield much information concerning the functions of the epiphysis or pineal gland, although from the knowledge that has been gained of this organ it is believed that it, as well as the suprarenal cortex, plays an important part in corporeal development. Thus there is established, beyond all doubt, a close relation between all the glands of the *hormonopoietic system*. Still the exact influence of one of those glands remains obscure according to Falta,<sup>1</sup> who states: "Only the thymus has not as yet found a secure position in the symptomatology of the ductless glands."

In connection with this disturbance of the internal secretions Barker<sup>2</sup> says: "More and more we are forced to realize that the general form and external appearances of the human body depend to a large extent upon the functioning, during the early developmental period (and later), of the endocrine glands. Our stature, the kind of faces we have, the length of our arms and legs, the shape

<sup>1</sup> Falta, Wilhelm. *The Ductless Glandular Diseases*. Translated and edited by Milton K. Meyers. P. Blakiston's Sons and Co., Philadelphia.

<sup>2</sup> Barker, Lewellys F. *On Abnormalities of the Endocrine Functions in the Male*.

of the pelvis, the color and consistency of the integument, the quantity and regional location of our subcutaneous fat, the amount and distribution of hair on our bodies, the tonicity of our muscles, the sound of the voice and size of the larynx, the emotion to which our exterior gives expression—all are to a certain extent conditioned by the productivity of our hormonopoietic glands. We are simultaneously, in a sense, the beneficiaries and the victims of the chemical correlations of our endocrine organs.”

The relation between the diseases of the central nervous system and especially of the psychoses, and the ductless glandular system has not as yet been determined, although various endocrinous syndromes have recently received attention in psychopathic hospitals and have been referred to in the literature. Disturbance of functioning of the thyroid and hypophyseal glands has been recognized as producing mental phenomena with its maladjustment, but aside from these endocrinopathies nothing convincing has been offered. White,<sup>3</sup> after discussing the subject of gonadal defect from the viewpoint of organ inferiority, states: “A defect at the level of the ductless glands is reflected in the psyche of the individual by his choice of work—by his conduct. The inferiority, which had the effect of preventing the development of the sexual characteristics that properly belonged to his sex—in general, masculinity—had the effect at the psychological level of producing conduct calculated to compensate for the lack.”

The term pseudo-hermaphroditism, in a restricted sense, is applied to a condition of the body characterized by the malformation of the genitalia in a contrasexual individual, and is supposed to bear a special relation to the functioning of the sexual glands; but the term is also used in a much broader sense and is applied to cases in which there may be no somatic evidence of deviations in the essential sexual apparatus, but in which the abnormalities are limited to the secondary sex characters or manifest themselves in the psychic behavior of the individual. The psychic deviations may, however, only be evident in the mental manifestations when there is failure of adjustment to the environment resulting in the development of a psychosis in which the unconscious is given free expression in the dissociation of the personality, and the sexual demands, whether they be of a heterosexual or of a homosexual nature, dominate the conduct of the individual. This condition has been termed psychic hermaphroditism. Biedl states:<sup>4</sup> “It has been asserted that physio-

<sup>3</sup> White, William A. *Mechanisms of Character Formation*.

<sup>4</sup> Biedl, A. *Internal Secretory Organs: Their Physiology and Pathology*.

logical hermaphroditism, by which is meant the presence of both sex glands in a state of physiological activity, is never encountered among the higher vertebrates." Falta cites the same author on this subject as follows: "In pseudohermaphroditism are found all conceivable varieties. There are cases of so-called somatic pseudohermaphroditism, in which not only the sexual organs but all the psychic characteristics prevail. (v. Neugebauer has collected twenty-five such cases.) Further there are cases in which the secondary sexual characters, such as hairiness, voice, dimensioning of the body, belong partly to one and partly to the other sex, and there are cases in which the sexual glands and genitalia belong to one, the secondary sexual characters to the other sex (pseudohermaphroditismus secundarius of Halban)."

In reviewing the opinions concerning the relations between the gonads and sexual characters we meet with two directly opposite views. First, that the sexual characters are in existence in the very beginning, there being three dispositions, the male, female and hermaphroditic, and that the function of the gonads acts as a protective stimulant to the development of the sexual characters. Second, that the sexual characters are directly due to the sexual glands and that when the differences between the male and the female are first observed in the embryonic stage the sexual glands have developed and their influence is traceable.

If man is bisexual, as many scientists claim, this dimorphism must be evident in the mental as well as in the physical development of the individual. It is assumed that every normal male and female retains cells of undifferentiated accessory sex organs of the opposite sex; that there is no such thing as a pure male or a pure female animal, that each contains the element of both sexes. Biedl says: "The secondary genital organs have a bi-sexual origin and, in the adult animal, these show a certain degree of hermaphroditism. This bi-sexual origin leads occasionally to the development of both sets of genital ducts and external genitals, thus producing instances of pseudohermaphroditism. Pseudohermaphrodites are individuals in whom the genital glands are unisexual, while the rest of the genital apparatus is, either wholly or in part, bisexual."

The following from Krafft-Ebing<sup>5</sup> in regard to sex development is of interest: "The original bisexuality of the ancestors of the race, shown in the female rudimentary organs of the male, could not fail to occasion functional, if not organic reversions, when mental or physical manifestations were interfered with by disease or con-

<sup>5</sup> Von Krafft-Ebing. *Psychopathia sexualis*.



genital defect," and he further states: "The individual being must pass also itself through these grades of evolution. The psychophysical sexual difference runs parallel with the high level of the evolving process. The individual being must also itself pass through these grades of evolution; it is originally bisexual, but in the struggle between the male and female elements either one or the other is conquered, and a monosexual being is evolved which corresponds with the type of the present stage of evolution, but traces of the conquered sexuality remain."

Falta, in reviewing the theories of sex determination, cites Biedl as supporting a hermaphroditic element in the sexual glands. "The secondary sexual characters develop in a masculine or a feminine direction, according as to whether the masculine or feminine internal secretory sexual glands predominate. The occurrence of heterologous sexual characters is explained by the supposition that the internal secretory portion of the sexual glands that belongs to the other sex obtains the upper hand."

Freud believes,<sup>6</sup> in the evolution of sexuality, that every individual passes through a bisexual stage in childhood; the homosexual component is suppressed during the normal evolution of man, but some vestige of it remains in a sublimated form, which may again become apparent. He contends that every heterosexual has a homosexual component and vice versa.

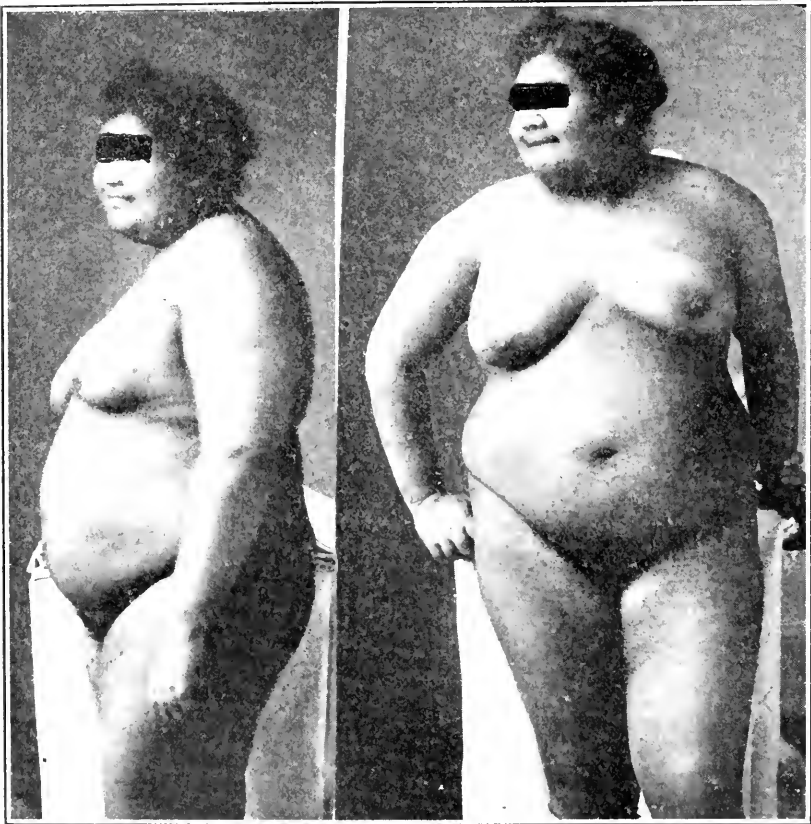
This series of cases presented for consideration is selected from a large group of women in the hospital who show decided biological variations in the growth and development of the anatomical structures of the body, as well as of the mental processes, resulting in a degree of external pseudohermaphroditism and also hermaphroditic behavior. The evidence of pseudohermaphroditism is confined to the secondary sex characters, as there are extremely few anomalous conditions of the primary generative organs. There appears to have been a normal corporeal development in these women up to the pubescent period, then the male secondary sex characteristics increased at the expense of the female. Many of the women in this series are in the involution period or have passed that stage and some of these symptoms herein described occur in women during this state and are then due to physiological decay or senescence, yet, in selecting this group an effort was made to include only such cases as had displayed this syndrome before the onset of the menopause.

<sup>6</sup> Freud, *Three Contributions to the Theory of Sex*. Nervous and Mental Disease Monograph Series, No. 7.

CASE I. Shows the following syndrome: bodily outline and facies, masculine, hypertrichosis, with male distribution; obesity; hands delicately formed, fingers tapering.

L. P. Colored woman; single; aged 17 on admission in 1911.

*History.*—Inclined to obesity from infancy; always healthy. Studied music and graduated from grammar school at 16, and was in first year of high school when mental symptoms developed. Missed promotion but once. Showed the first nervous symptoms in



CASE I. Shows obesity, hypertrichosis with male distribution; facies heavy and masculine in type. Hands and feet delicately formed, fingers tapering.

1911, when 17 years of age, following a severe fright. One day while sitting at the window saw two colored boys engaged in a fight. She was later summoned as a witness in court in this case. Following this became excited and said that she was to be arrested and appear in court. Whenever she saw a policeman became terror-stricken. Finally passed into a mute, negativistic state in which she still remains.

*Physical Examination.*—Showed these anomalous conditions: great adiposity; this has varied during her residence in the hospital. When admitted height 5 ft. 3 $\frac{1}{4}$  inches, weight 174 lbs. One year later 244 lbs., two years 253; present 236 lbs. Abdomen and breasts pendulous, as well as other parts of the body.

*Hair.*—Heavy on head, grows to a point (widow's peak) on forehead; mustache on upper lip, growth of hair on cheek extending from the temporal region over the parotid region and the angle of the jaw; growth of hair well distributed under the chin; axillary hair abundant and reaches below the usual distribution; pubic hair rises in a point to the umbilicus; some of these hairs are 1 $\frac{1}{2}$  to 2 inches long; heavy growth over the abdomen; heavy distribution of long, coarse hairs over the thighs, more marked over inner and anterior surfaces, and extends over the posterior surface to the popliteal space, gradually disappearing down the leg. Eyebrows are heavy.

*Hands and feet* well formed, pointed, rather small in size. Fingers and toes taper.

*Digestive System.*—Mouth in good condition, teeth well formed, tongue clean, bowels regular.

*Chest.*—Lungs normal; heart normal; blood pressure—systolic 120, diastolic 90.

*Glandular System.*—There is no fulness of the thyroid and no retrosternal dullness.

*Pelvis.*—External appearance normal, although both internal and external labiae are not very well developed; labia minora hardly noticeable. Hymen annular, unruptured. Menses appeared in seventeenth year and has not been regular since. Amenorrhea for the past four years. Had regular menstruation in April, 1917.

*Laboratory Findings.*—Urine negative. Wassermann with blood serum negative.

*Neurological Examination.*—Patient is inaccessible and will not coöperate with the special sensation tests.

*Reflexes.*—Deep reflexes are slightly exaggerated; superficial reflexes are normal.

*Mental Examination.*—Mute and negativistic as a rule, never talks; occasionally will smile when spoken to. Comprehends everything, but does not show any reaction to her environment. Infantile in behavior.

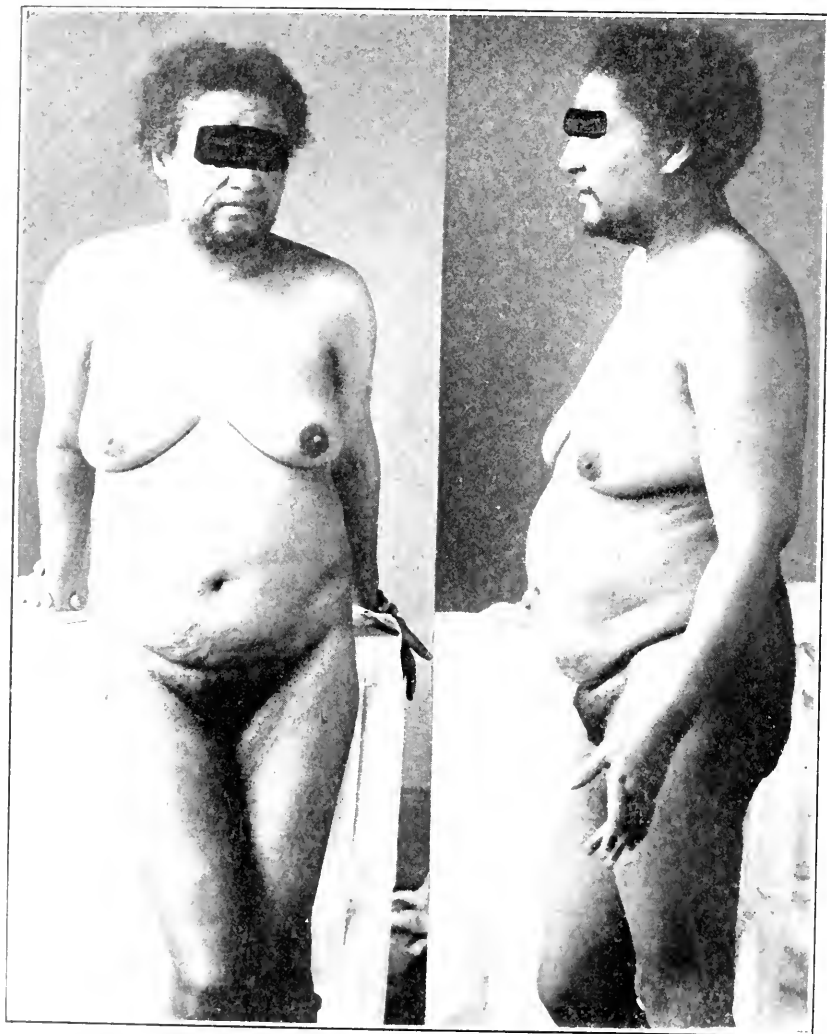
*Summary.*—The notable features in this case are the tendency to adiposity from birth; delayed menses with almost constant amenorrhea. A severe fright during adolescence with a subsequent psychosis with præcox mechanism. The physical masculinity is striking; this woman may be taken for both a man and a woman or either a man or a woman, depending upon the clothing worn. There is hypertrichosis of the face and body with masculine distribution. The external genitalia shows development to a degree infantile. The hands and feet are well formed and pointed fingers tapering.

It is possible that there is a disturbance of the hypophysis, the gonads, and probably the suprarenals.

CASE 2. S. M.: Hypertrichosis; obesity; exophthalmus.

Colored, aged 44, married; admitted November, 1915.

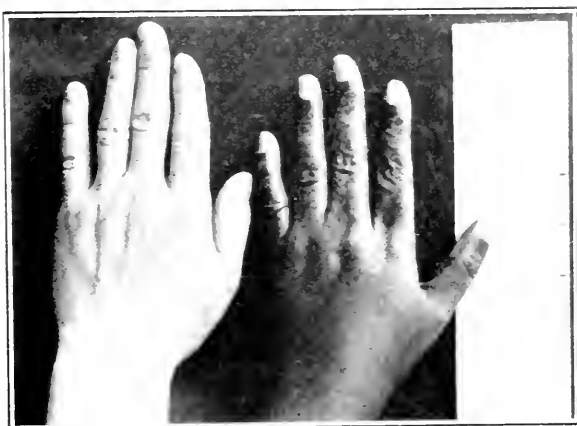
*Family History.*—Shows considerable white blood in the antecedents. Mother living; had a stroke of paralysis.



CASE 2. Contour of body masculine in type; obesity; hypertrichosis with male distribution. Gracile hand (Mona Lisa type), small and conical, fingers tapering. Joints very flexible with extreme hyperextension. Exophthalmus.

*Personal History.*—Born in Virginia; first child in family of seven. Was an unusually bright child, completed high-school work

at seventeen; entered Howard University; left because of persistent attentions of a young man, and completed her college course at Storer's College; taught school in the country. Before her nineteenth year she had an attack of nervous prostration; there is an indefinite history of severe convulsions at this time. Patient recovered from the acute symptoms of this attack in three months, but did not resume teaching again for one year (probably a *præcox* episode). She married when twenty a school teacher; married life was unhappy; her husband did not entirely support his wife and she continued to teach and they lived with her mother. Three children were born of this union, two stillbirths and one child lived a few hours. During her last pregnancy husband told her he had contracted syphilis. She ran shrieking from his bed into the room of her parents and slept with them. She appeared to be suffering from a great fright. After this child was born it was syphilitic and died soon afterwards. She showed mental symptoms after her husband disclosed this fact to her. After the birth of her child she became unmanageable and



CASE 2. Gracile hand, extremely delicate in outline, fingers tapering, joints flexible, show hyperextension.

required the constant attention of her relatives. She did not recover from this psychosis, but her relatives were able to care for her until a few months before admission, when she became so untidy that they were compelled to send her to an institution. During the period of her psychosis she always called herself "Bill," and insisted that her relatives address her as Bill. This was her father's name. Her relatives state that they have a small photograph at home of her father, which resembles the patient at the present time, in fact the picture of her father seems to be an exact prototype of her.

*Physical Examination.*—Large, obese, light-brown colored woman; muscles soft and flabby; height 5 ft. 2¾ inches, weight

135½ lbs. Face approaching the Semitic type; expressionless; skin yellow, but somewhat deeply pigmented over the buttocks; many pigmented scars, the result of an accident over various parts of the body; mucous membrane rather pale. Hair abundant and kinky, grows to a peak over the forehead. Marked hypertrichosis of the chin and under jaw; moderate hypertrichosis on the upper lip. Hair abundant in the axilla, moderately abundant over the pubis, transverse distribution. Mammæ quite large and pendulous. Hands very small, with delicate tapering fingers. Feet small and toes taper to a point. Joints very flexible; show considerable hyperextension.

*Head.*—No areas of cranial dullness; ears well formed and lobes partly attached. Eyes show considerable exophthalmus but patient will not coöperate in other thyroid tests. Pupils contracted, round and equal. Nose aquiline, no obstruction.

*Digestive System.*—Patient will not open her mouth wide enough for a proper examination, but it can be seen that the palate has a ridge down the center. Tongue clean, protrudes in the median line.

*Thorax.*—Barrel shaped. Lungs normal; heart normal. Blood pressure—systolic 124, diastolic 98.

*Abdomen.*—Large and pendulous.

*Glandular System.*—There is no fullness of the thyroid and no retrosternal dullness suggesting thyroid enlargement. Palpable lymph glands in the left axilla.

*Pelvis.*—External appearance normal; slight tear on the posterior of the vagina, uterus low; os firm and hard. Cervix short.

*Reflexes.*—Biceps elicited on the right; all other deep reflexes present, but knee kicks more active on the right than on the left. Pupils react to light and accommodation.

No coöperation could be obtained for further neurological examination.

*Mental Examination.*—Shows advanced deterioration. Has had a psychosis for fifteen years. Little known of the onset. Present symptoms are apparent indifference to her surroundings, requires constant attention from the nurses, never speaks, has shown mutism almost constantly since admission.

*Summary—Physical.*—General outline and appearance masculine. Obesity, hypertrichosis with male distribution. Hands very small, with delicate, tapering fingers (Mona Lisa hands). Feet small and toes taper to a point. Exophthalmus present, but no other evidence of thyroid disturbance.

*Summary—Mental.*—Præcox type of reaction.

The important features in this case are the external evidence of pseudo-hermaphroditism. There is a general masculinity in the corporeal development, including obesity. There is marked hypertrichosis with the general male distribution, which gives the facies a decidedly masculine appearance. She shows no enlargement of the thyroid but has some exophthalmus. The mental symptoms developed following a fright, although the patient had a psychosis during the early adolescent period. The mental conflict first developed during the pubescent period, but the patient made some sort of a mental adjustment after three months. Her marriage was unhappy,

she always lived in the parental home and apparently could not adapt herself to the demands of wife and motherhood. She finally seeks oblivion in a psychosis, shutting out reality and existing in a world of fancy. Little is known of the early symptoms, but this patient probably had an attachment for her mother, and it is possible that she identified herself with her father. She called herself "Bill," her father's name, and only responded when thus addressed.

CASE 3. Shows hypertrichosis; facies masculine with heavy beard. Psychosexual instincts vary from homosexuality in the depressed stage to heterosexuality in the excited stage.

J. K. M. White; single, aged 49; third admission, 1916.

*Family History.*—Sister and brother rather nervous temperaments. One sister had exophthalmic goiter. One cousin insane.

*Personal History.*—Always healthy as a child. Common school education. Clerk in government department. Menses established at 13, but had considerable amenorrhea during the first few years. Hypertrichosis appeared before she was 20 and she has been compelled to shave her face regularly ever since. Had numerous beaux but no sweethearts. Had no affection for her father, but was excessively fond of her mother and was jealous of her attentions to the other children. She read a great deal and has some talent as a singer. In August, 1914, a partial hysterectomy was performed for uterine fibroid. Was more nervous and excitable after this. Became interested in Christian Science, which she abandoned in a few months and took up "New Thought," as she wished to become a healer. After a favorite nephew's death in December of 1915 she became excited, noisy, laughed and sang, was irritable and violent. From that time she has had several attacks of excitement and was treated in sanitariums. Finally was brought here. Made rapid recoveries, was discharged and readmitted. When excited she assumes a masculine bearing, is boisterous, speaks in a heavy voice and her general behavior is distinctly of the aggressive, domineering individual.

*Physical Examination.*—Patient is a well-nourished woman. Gait and posture are normal. Numerous small pigmented moles over the body. Hair of head is abundant and gray. There is hypertrichosis of the chin, cheek, upper lip and thighs, both on the outer and inner surfaces. There are numerous coarse hairs along the linea alba. The voice is deep and powerful. Skin is moist. Patient is 5 ft. 4¾ inches in height and weighs 147 lbs.

*Respiratory System.*—The thorax is well formed. Expansion good and equal on the two sides. Breath sounds clear on percussion and auscultation.

*Circulatory System.*—Area of cardiac dullness not increased. Both sounds heard at apex and base. No murmurs. Pulse 76 to the minute, regular in force and rhythm. Tension does not appear increased. Blood pressure—systolic 142, diastolic 90.

*Alimentary System.*—Teeth show many fillings. Tongue is clean, pharynx clear. The abdomen is natural in appearance. There is a post-operative scar along the linea alba. No tenderness.

*Glandular System.*—No general glandular enlargement. Mammæ are well developed.



CASE 3. Some obesity; hypertrichosis with masculine distribution, has shaved her face twice a week for years. During depressions inclinations and desires are homosexual, during excitements heterosexual.

*Genito-urinary System.*—Vulva appears normal. There is no discharge. Vaginal orifice admits one finger. Uterus and adnexa are not felt.



*Nervous System.*—No subjective complaints.

*Objective Findings.*—*Cranial nerves:* (1) Differentiates odors. (2) Vision is good. (3, 4 and 6) Eye movements normal. Pupils react to light and on accommodation. (5) Sensation of the face normal. Muscles of mastication strong. (7) No facial asymmetry. Movements good. (8) Audition unimpaired. Equilibration good. (9, 10 and 11) No difficulty in swallowing. No abnormality. (12) Tongue protruded in the midline. Movements good.

*Taste.*—Sweet, sour, salt and bitter differentiated.

*Tremors.*—No tremors noted.

*Sensation.*—Tactile, thermal and pain sense present.

*Speech.*—Test words enunciated clearly.

*Motor System.*—Strength and coördination good. Romberg sign negative.

*Reflexes.*—Superficial—cranial, pharyngeal, epigastric and abdominal reflexes active. Plantar stimulation gives plantar response. Deep reflexes—biceps, triceps, wrist, patellar and Achilles reflexes active.

Mentally is manifested a manic-depressive psychosis; she passes through a period of depression, a period of excitement and a lucid interval. This woman has critique and realizes her condition. She discusses her difficulties quite freely. She says that there were periods all through her life when she believed that she might be asexual; that during her psychosis she is not certain as to which sex she really belongs. Her instincts are masculine at times and again are feminine, the hirsute growth on her face, which required shaving her adult life, gave her a distinctly masculine appearance and her behavior has been decidedly manlike and at time she feels that she is of the male sex. She is strongly attracted to one of the young women nurses on the ward and she has feared at times that she might harm her. She has a strong mother attachment, which she discusses freely.

This case is unusual, as it belongs to the class of pseudo-hermaphrodites of the external type. For while the pelvic organs and external genitalia developed normally, yet, the secondary sex characters show a marked deviation from the normal. The facies with the coarse skin and heavy beard (which required shaving every day for years), the voice is coarse and speech when out of sight would lead one to think that a man were conversing. The mental processes and behavior vary between homosexuality and heterosexuality, depending upon the emotional state of the individual. There is apparently a pluriglandular disturbance causing this endocrinopathic condition, but the determination is impossible, although there is probably an endocrinopathy of the adrenal cortex.

CASE 4. Manifests contour of the body and facies decidedly masculine in appearance; hypertrichosis; obesity; enlarged thyroid; vaso-motor flushings with hyperidrosis. Mental bisexuality; during depressions homosexual, during excitements heterosexual.

S. M. White; age 46 on third admission in 1912; teacher.

*Family History.*—Negative.

*Personal History.*—Was a delicate, much petted child, the only

child for eight years. Up until the time she was five years old she suffered from severe nausea every night. For this reason she slept with her parents. She slept with her head on her father's shoulder. Her mental trouble seems to date from a fall from a horse when she was about 24 years of age. She was riding with a cousin, to whom



CASE 4. Outline of the body masculine as well as facies. Obesity, some enlargement of the thyroid, slight exophthalmus; hypertrichosis, masculine distribution on the face with partial male distribution on the body. Voice heavy and masculine during excited periods; hands well formed, fingers tapering. Bisexuality. During the depressed and lucid periods is homosexual and during the excited periods is heterosexual.

she was engaged, when she fell and was rendered unconscious; when she regained consciousness she was lying in her cousin's arms with her head upon his shoulder. This incident occurred in the month of October. She remained more or less of an invalid for one year and the following October developed a psychosis. Has

had twelve attacks previous to this one, and it is of interest that each one began in the month of October. During the last three attacks has been an inmate of this hospital and has been a permanent resident since October, 1912. She is in a quiescent state during the summer months, but as the month of October approaches she gradually becomes excited and the excitement continues during the winter.

*Physical Examination.*—Hair coarse and abundant, mixed with gray. Hair of eyebrows abundant, slight excessive growth of hair above left eyebrow. There is a slight tendency for the hair to grow to a point on the forehead (widow's peak). Axillary hair abundant, pubic hair abundant, transverse superior line. Features coarse, masculine in appearance. Mucous membranes normal. Ears well formed, lobes adherent. Asymmetry of outer line of the left ear. Eyes blue, pupils round and equal. Slight exophthalmus. Nose shows considerable obstruction on both sides. Mouth: Teeth in fair condition, pharynx clear, palate high arched.

*Glands.*—No retro-sternal dullness. Slight fulness of thyroid. Tremor of fingers.

*Hair.*—Hypertrichosis over the nipples and between the breasts, over the outer surfaces of the thighs. Several long hairs about one and a half inch long between the pubes and umbilicus. Hair of the face extends over the parotid gland on the sides of the face. Hands: small, tapering. Tremor of the fingers. Voice masculine during excited period. Some slight obesity.

*Lungs.*—Normal.

*Heart.*—Soft, systolic blow at the mitral area, well transmitted over precordia. Heart sounds not increased. Pulse rate 102; blood pressure during excitement, systolic 222, diastolic 84.

*Vasomotor.*—Pale, flushing and cyanosis from emotional disturbance. General hyperidrosis of the whole body.

*Reflexes.*—Brachial, triceps and wrist active. KK not elicited until reinforced. Plantar response normal. Pupils equal and react to light and accommodation.

*Gynecological.*—Genitalia normal. Hymen annular, unruptured.

*Mental Diagnosis.*—Manic-depressive psychosis. During the depressed periods this patient appears as an awkward, bashful, retiring, self-conscious woman. She is retarded and careless in dress and is on the whole a very unhappy individual. Then for a short interval her behavior is that of a normal, intellectual woman of considerable culture. During the excitements she is aggressive, dictatorial, boisterous, noisy, speaks in a loud, powerful tone of voice. At these times the content of the unconscious is then given full expression, she says "I am a man," "I know I am a man," "I feel like a man," "My throat feels like a man's," "My conduct is manlike," "If I were not a man I would not have a beard like one."

Psychoanalysis has brought out the fact that this woman has the sexual instincts and desires of a homosexual individual during the depressed and lucid intervals and then there is a transformation of character and during the excitements she is decidedly heterosexual. She has a very clear insight of these various emotional states and discusses them freely with her physician.

The important features in this case are the outward sex-ensemble of maleness marked in the secondary sex characters, and in the mental processes a bisexuality which varies in the individual according to the emotional state. There is a fullness of the thyroid; alternate paleness and flushings; general hyperidrosis of the body; and during the excitements high blood pressure, which subsides in a degree during the depressions.

CASE 5. General bodily configuration shows maleness; marked hypertrichosis; thyroid enlargement; obesity; menstrual irregularities; homosexuality.

G. H. White; age 32; single; clerk.

*History.*—Father an alcoholic, left home when patient was about 18 years of age. Mother had a psychosis after this which lasted three months. One maternal aunt had hypertrichosis. Patient 32 years of age. Common school education; willful as a child, had fits of temper when not allowed her own way. Menses established at 13, was not regular for two years, had metrorrhagia; at present amenorrhea. Hairy growth on face coincident with appearance of menses; appearance of long growth of hair on body since puberty. She has found it necessary to shave her face twice weekly for years. She was always obese and six years ago weighed 200 lbs. Worked as a stenographer for twelve years with only a small compensation. Never received any attention from men and never cared for them. After her brother's marriage two years ago became depressed, failed in efficiency and finally gave up work, as she felt she was too ill to work any longer. Had a strong attachment for her mother. Was admitted to this hospital September 7, 1916.

*Physical Examination.*—Well nourished. Height 5 ft. 4 inches. Considerable adiposity, yet skin is loose and patient has lost weight. When admitted weighed 148 lbs., present weight 105 lbs. Before illness weighed 200 lbs.

*Hair.*—Long, red, straight. Hypertrichosis of face, chin and entire body. (Has shaved face twice a week for several years.) Over the abdomen there is a heavy growth of hair. Shows a triangular distribution over the pubis to umbilicus; outer surfaces of legs and arms covered with long red hair. Skin over the abdomen loose and shows loss of subcutaneous fat; the breasts are loose and flabby. Thyroid enlargement; both isthmus and lobes; fingers stubby and nails bitten short.

*Respiratory System.*—Chest full and deep. Vocal fremitus normal. No abnormal areas of dullness on percussion. No adventitious sounds on auscultation.

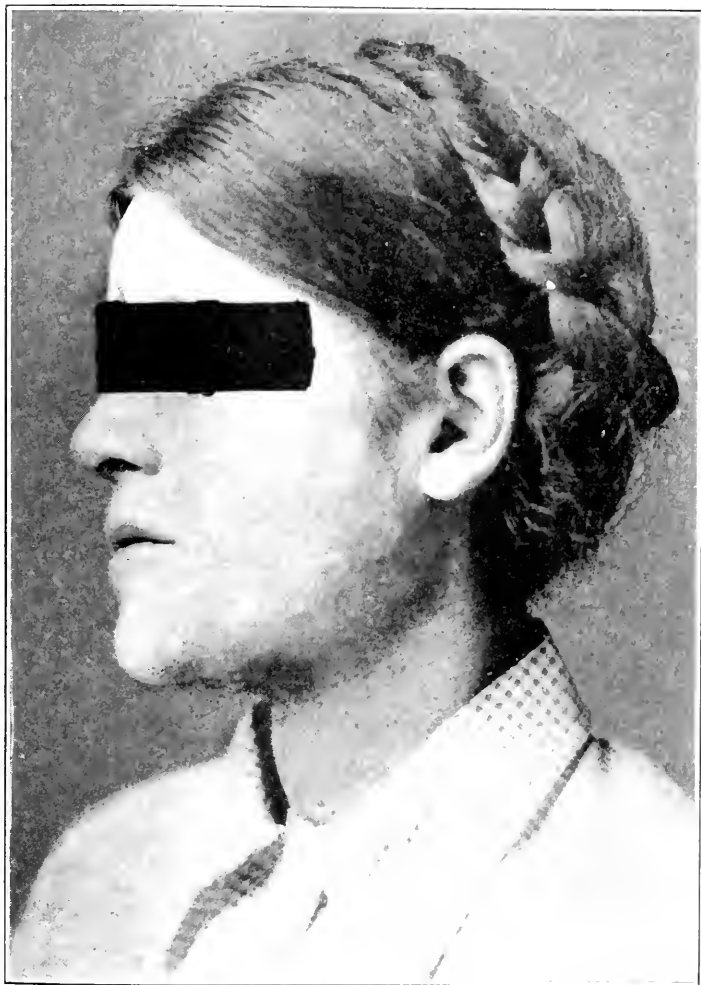
*Circulatory System.*—Area of heart dullness normal. Apex beat palpable  $8\frac{1}{2}$  cm. from midsternal line fifth interspace. Heart sounds clear, regular, no murmurs noted.

*Alimentary System.*—Teeth in good condition. Tongue clean. Appetite poor; digestion fair. Patient usually constipated. Liver and spleen not palpable.

*Genito-urinary System.*—Hymen admits three fingers. Vagina wall congested. Small nodule on anterior uterine wall. Cervix somewhat soft, small. Leucorrhea present.

*Glandular System.*—No superficial glands palpable.

*Gynecological.*—Vulva normal. Uterus rather of the infantile type; menses established at 13. Metrorrhagia for a couple of years. Amenorrhea since mental trouble began.



CASE 5. Obesity; marked hypertrichosis over the whole body, male distribution, for years has shaved her face several times a week. Thyroid enlargement.

*Laboratory Findings.*—Urine: Reaction acid; sp. g. 1.330; albumen present; sugar negative; granular casts. Wassermann with blood serum negative.

*Mental Symptoms.*—Medical certificate stated: "Patient self-willed and determined. First symptoms October, 1915, had hallucinations, fear of being discharged from position, imagined food and medicine were poisoned, that her touch would contaminate a person, constant crying out and demanding that her mother be in the room. Present symptoms: Constant calling out for things she cannot get, fears anyone to touch her, afraid a bat would come in the window and catch her, imagines her body is poison if touched."

On admission was resistive; spoon-fed for two days; kept calling for her mother; would not leave her bed in the morning until the nurses assisted her to dress; said food was poisoned; talked of her brother and his wife; said she hated his wife and hated her brother also; then said: "I love and I hate him."

The following psychoanalysis was made in this case.

A rather headstrong, intractable, secretive child with contracted interests and few attachments, the attachments to her mother and brother being strongest. She slept with her brother until she was seven years old, and found the separation at that time unwelcome. Now she fears to go to bed at night, declaring that the devil is under the bed. When asked who is "the devil" she says "my brother, I guess." She thinks of her brother at mealtime and wishes she could have him tube-fed; that she could lock him in "behind closed doors" like herself. She fears to eat and cannot explain why (the poisoning fear was probably a rationalization; no longer present). The incestuous wish is apparent here, in conflict with the strong negative transference upon the brother ensuing upon his marriage to a woman whose character and conduct contributed to the deepening of the resentment.

The fixation on the mother appears to be strongest, and shows identification with the mother. She slept with the mother for the last few years, and the memory of this is present when bedtime comes. This time brings a conflict of feelings, so that she dreads the night and equally dreads the morning. The resistance against the incestuous wish for the brother added to the wish for the mother causes the conflict. When talking of her troubles she makes her brother's unfilial and selfish treatment of her mother the main cause of her illness. She reiterates in a "rote manner" a great many insignificant facts of her life. All these are "covers" for the real, unconscious wishes and conflicts lying at the bottom of the psychosis. Her identification with her mother, through a homosexual fixation upon the mother, thus brings another determining element into the brother conflict. In such cases narcissistic manifestations are much on the surface. Anal-eroticism is seen in the constipation, begging for enemas (this tendency appeared in the word association test) and secondarily in obstinacy and jealous tendencies of the character.

Homosexual trends are naïvely expressed. When the psychoanalyst takes her into a room for an interview she expresses a desire for a nightgown and to get into bed. She says: "I love all the lady doctors. And I haven't had any company for three and one half years." "And Dr. M. and Dr. A. are so nice to me." "I want all the women doctors to examine me."

The marriage of her brother precipitated the conflict of incestuous tendencies that had been growing ever since puberty.

Here is a young woman with external evidence of pseudo-hermaphroditism, whose psychosexual instinctive life is homosexual, who is unable to meet her difficulties in a healthy way, shows an abnormal type of reaction and relapses into a psychosis.

CASE 6. Masculine appearance; hypertrichosis with obesity; homosexuality.

J. G. White; aged 37; single. Hebrew.

*Family History.*—Negative. Father died before patient was born.

*Personal History.*—Youngest in a family of four. Common school and musical education. Menses established at seventeen; had amenorrhea for the first three years, regular since. Hypertrichosis appeared when about nineteen years of age. Always enjoyed good health, except in twenty-ninth year had attack of rheumatism which lasted one year. She was always self-willed and domineering and desired to have her own way. Seclusive and preferred to remain by herself when at home. During her girlhood days became attached to a woman much older than herself, whom she says had an evil influence on her. She was so fascinated with this woman "that she could not keep away from her." Says she was in love with her and that this woman reciprocated this feeling, that they had indulged in a great many homosexual practices. When she was older she left home to live with a Christian woman. She lived with this woman for some time against the wishes of her family. She was engaged to marry a man to please her family, but she finally broke the engagement, as she did not love him. This woman has a strong attachment for her mother.

*Present Illness.*—Four years before admission became untidy in appearance, refused to wear clothes provided for her, wrapped herself in wet garments and did many other irrational acts. Was depressed and cried a great deal, then would become excited, throw herself on the floor and scream for hours. Was treated in two private sanitariums. She became so attached to the nurse that she would not allow her from her sight. She was treated at home for a period by a nurse, but the nurse left, objecting to the sexual advances that the patient made to her. When admitted here was excited and wept and cried alternately without adequate reason. Cried constantly for her nurse, whom she thought should not be separated from her. Begged for mother to visit her; when mother appeared would strike her and refuse to go out with her. Asked to be allowed to go home with her relatives when they called, but would assault her mother as soon as she entered her presence. Threw a hammer at her mother several weeks before she was received here.

This is a manic-depressive reaction with hermaphroditic tendencies; the patient is homosexual with a mother attachment during the normal and lucid intervals, but shows a tendency to a heterosexual striving during the extreme excitements. She hates her brother, whom she says persecutes her, says she loves her mother, but as soon as the latter comes in her presence she assaults her.

*Physical Examination.*—General type masculine, musculature vigorous and well developed. Bones and joints large. Height 5 ft. 5 inches, weight on admission 167 lbs.; present 185 lbs. *Skin* smooth but rather coarse in texture, moist. *Eyes:* Expression bright,



CASE 6. General appearance masculine, obesity; hypertrichosis with male distribution; homosexuality in depressed periods and lucid intervals and heterosexuality in excited periods.

irides brown, pupils equal and regular. *Hair* coarse, black streaked with gray, moderate growth. Coarse hair on sides of face, chin and upper lip; coarse, heavy growth of hair on outer and inner surfaces of thighs; pubic hair abundant and rises in a point to the umbilicus;



axillary hair heavy and long; considerable growth of long hair on the arms. *Ears:* Well formed. *Eyes:* Some nystagmus. *Mouth:* Tongue coated. *Teeth:* Very few present; some pyorrhea; palate high arched. *Hands:* Delicately formed, fingers tapering; nails pointed. *Feet:* Foot flat but pointed and tapering to the toes. *Thyroid:* Isthmus palpable and prominent; no retrosternal dulness.

*Respiratory System.*—Chest well formed, breasts pendulous. Lungs normal.

*Circulatory System.*—Outline of heart normal; sounds regular, strong and distinct; no murmurs. Apex beat not seen or felt. Pulse 72, regular, good quality. Blood pressure, systolic 175, diastolic 98.

*Alimentary System.*—Normal. Abdomen prominent. Walls thick. Liver and spleen not palpable.

*Genito-urinary System.*—External genitalia normal. Vagina admits two fingers, cervix normal. Position of uterus good. No pain on palpation of ovaries.

*Glandular System.*—Inguinal glands palpable.

*Nervous System.*—No subjective sensations. Cranial nerves normal. Cutaneous sensibilities normal. Motor functions show a slight tremor of extended hands.

*Reflexes.*—Superficial present. Deep: Triceps more active on the left side. KK more active on the right side. Tendo-Achilles equal and active. Pupils react normally.

Here we have a single Hebrew woman, aged 37 years, who shows the following: Endocrinopathy, pseudo-hermaphroditism, maleness with hypertrichosis, heavy beard of the face, growth of hair in front of the ear and over the malar area; moustache on upper lip, a long growth of hair on the chin. Hairiness of the inner and outer thighs; pubic hair abundant and rises in a point to the umbilicus, considerable long hairs on arms; axillary hair abundant and long. The voice is heavy and masculine in character. There is obesity. Gracile hand, pointed, tapering fingers. Mentally has shown a strong attraction to members of her own sex and even had homosexual relations with them. Left home when quite a young woman and lived with some Christian women for a time. The psychosis in this case is manic-depressive and this patient's homosexual tendencies are quite evident, but during the excitements is decidedly heterosexual.

CASE 7. Hypertrichosis; obesity; pseudo-hermaphroditism of external type.

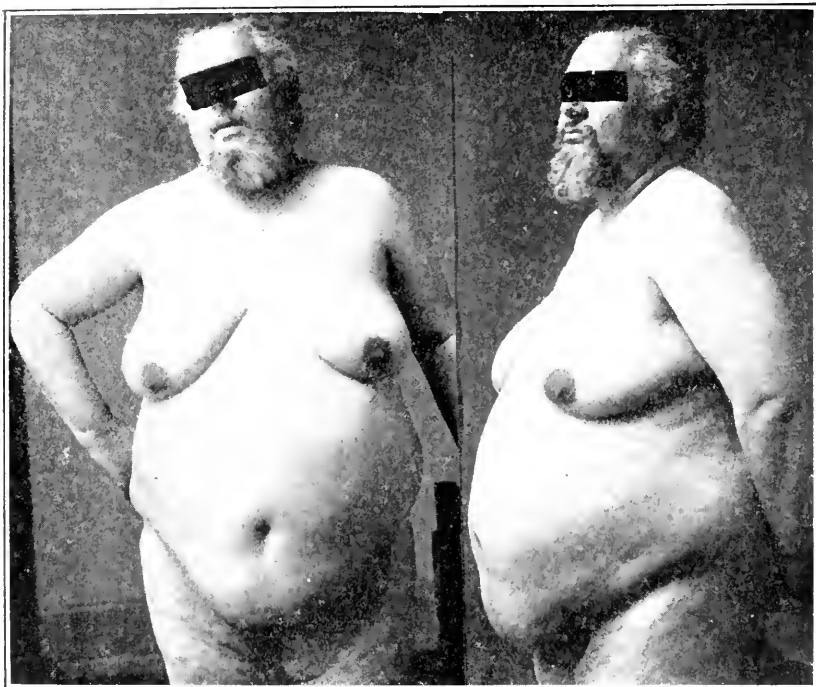
M. B. White, aged 32 on admission, April, 1899. Single.

*Family History.*—Mother died from paralysis.

*Personal History.*—Born in Washington; had measles, mumps and whooping cough when a child. Learned readily at school and reached the eighth grade; refused to go to school any longer. As a child was self-willed and inclined to have her own way; was high tempered; always had a shut-in makeup and preferred to remain at home and play with dolls rather than to romp and play with other children; never made friends among the children of the neighborhood and was always selfish in dealing with her brothers and sisters; would not assist with the housework; preferred to sew; never

cared for men and never had any attentions from them. Menses appeared at 15 but was never regular while at home (patient still menstruates irregularly). Hypertrichosis appeared on her face at twenty. Psychosis appeared five years before admission.

*Physical Examination.*—(In 1903.) Is generally in a state of negativism, marked degree of *cerea flexibilitas*. Very stout, appetite good. Chest large and symmetrical. Has a masculine appearance, with hirsute appendages to lip and chin. *Lungs* and *heart* healthy. Vasomotor dilatation on excitation very marked.



CASE 7. General appearance, pose, and attitude distinctly masculine; obesity; hypertrichosis, with male distribution; hands and feet well formed and taper to a point.

(March 23, 1916.) General type and appearance: Patient is very stout, with pendulous abdomen. Weight  $234\frac{1}{2}$  lbs. Height 5 ft.  $4\frac{1}{2}$  inches. No apparent deformities of bones or joints. Breasts very large and pendulous. Skin of the face is quite florid. Hair: Heavy growth on head; hypertrichosis of the upper lip and chin amounting to a heavy beard. Axillary hair is abundant; the pubic hair rises high on the abdomen but the distribution is transverse; heavy folds of fat hang down about the hips. Skin over this area is reddened, probably from long sitting. Hands and feet well formed and taper to a point.

*Head.*—No areas of tenderness. Ear lobes well formed. Nose straight but bulbous and prominent, masculine in type. Apparent complete obstruction on both sides. Patient is a mouth breather.

*Chest.*—Barrel-shaped. *Lungs and heart* negative.

*Gastro-intestinal.*—Tongue clean; teeth in poor condition. Palate normal.

*Reflexes.*—Superficial: Conjunctival present. Plantar stimulation gives prompt response. Deep: All present, but very slight response and difficult to elicit. Pupillary: pupils widely dilated but equal; they respond to direct and consensual light but do not contract all the way down and after the first contraction, requiring only a second in duration, they expand again almost if not entirely to the previous extent, though the light is kept fully on them. To accommodate they contract more fully and remain contracted.

*Urine.*—Few hyaline casts in 1913. At present negative. Wassermann negative.

*Mental Examination.*—The first notation in this case was made after a residence in the hospital of five years as follows: Sensations are very disagreeable and principally subjective. Very quiet and indifferent to her surroundings. Is mute. Facial expression lacks interest or intelligence and is mask-like. Irritable when disturbed. Is in a state of general negativism. Since then the picture has been a dementia præcox reaction. Untidy in appearance, constantly expectorating on her clothing, so much so that it was necessary to supply her with a long bib, which is changed several times a day to keep her clean. Reacts to unpleasant hallucinations, especially of an auditory type. Will scold to herself. Sits on the same chair every day, spends her time in idleness.

Here we have a white woman with obesity, and a growth of beard very heavy and long. This hypertrichosis began soon after the appearance of puberty. This young woman never care for the male sex, never had any attentions from them. The habit of constantly expectorating is symbolic and is meaning evident to the psychoanalyst. Little is known of the early development of this psychosis. The physical masculinity is striking in this case and the clinical picture may be classed as virilismus or hirsutismus, the "masculine woman." There is without a doubt a dysfunctioning of several of the endocrinous organs in this case but just what this dysfunctioning is cannot be determined, as the influence which the several hormones have on each other in the normal development of the individual is as yet unknown.

CASE 8. Obesity; hypertrichosis and homosexuality.

M. M. Colored, widow, age 45.

*History.*—Always healthy; married at 21, husband left her three years later. Had two children; one died of tuberculosis; the other one is a musician. Since her husband died has earned her own living. While she was heterosexual to a degree, yet she also had homosexual practices with many women. She finally became jealous of the woman with whom she was living and threatened her when she was arrested and sent to the hospital.

*Medical Certificate.*—Physical condition good. Present symptoms: Says that a person by the name of Sallie Lewis "hoodooed" and "conjured" her room and herself. Says this Lewis woman believes after she has "hoodooed" a place the people of this place lose their friends. Because of this God dictated a letter. God said to her she was a "hoodoo," a conjurer and a liar, and Hell was too good for her. God says the wires are cut and current is stopped and she can not bother people any more. Says God gave her 4,000 poems which showed her how the Titanic was sunk. On one or two occasions she has seen the Lord.



CASE 8. Coarse heavy features with obesity; hypertrichosis with male distribution; homosexuality.

*Physical Examination.*—Large, obese colored woman; height 5 ft. 2 in., weight 197 lbs. Hair kinky, abundant on the head and mixed with gray; hypertrichosis of the face, hair of the temporal region extending down to the heavy beard on the chin; quite a growth of hair on the upper lip; long growth of hair on the chest; pubic hair heavy, extending toward the umbilicus; abdomen pendulous, breasts large, pendulous and flabby.

*Respiratory System.*—Chest wall full and deep. Respiratory excursion free. Tactile fremitus normal. No abnormal areas of dullness on percussion. No abnormal sounds on auscultation.

*Circulatory System.*—Area of heart dullness normal. Apex beat palpated 5½ cm. from mid-sternal line in fifth interspace. Heart sounds clear and rhythmic. No murmurs noted.

*Alimentary System.*—Teeth in fairly good condition. Tongue clean, throat normal. Appetite good. Digestion good. Bowels regular. Liver and spleen not palpated.

*Genito-urinary System.*—External genitals normal. No discharge noted. Uterus and cervix in good position.

*Glandular System.*—No superficial glands palpated.

*Neurological Examination.*—*Subjective complains*—none made.

*Objective Findings.*—*Smell and taste* normal. *Sight:* Eyes steady in movements and expression. Pupils 3 mm. in diameter, react sluggishly to light. *Hearing:* Ears normal in shape. Ticking of watch heard six inches from each ear. No discharge noted. *Tremors:* Fine tremor of tip of protruded tongue. *Sensation:* Thermal, tactile and pain sense normal. *Speech:* Test phrases pronounced in fairly creditable manner.

*Motor System.*—Strength good. Coördination fair. No Romberg.

*Reflexes.*—Conjunctivæ and epigastric normal. Plantar sluggish. No Achilles, no ankle clonus.

This woman shows the following evidence of pseudo-hermaphroditism: External appearance of striking maleness with the facies of a masculine type with the hairy distribution of the male sex. Gives a concrete history of homosexual practice for years; the mental mechanism is distinctly of the homosexual type with the paranoid ideas.

This is another case in which the marked glandular disturbance is apparent in the anatomical configuration of the body and more especially in the secondary sexual characters and the mental masculinism displayed.

CASE 9. Adipose woman of male type and stature; hypertrichosis and imperfect acquirement of secondary sex characters.

E. K. White; single; aged 39. Mental diagnosis imbecility.

*Family History.*—Father died patient in this hospital.

*Personal History.*—Feeble-minded young woman who has been a dependent charge of the District of Columbia since early childhood. Received in this hospital from institution at Elwyn, Pa.

*Physical Examination.*—Some obesity; height 5 ft. 1½ in.; weight 135 lbs. No deformities; face with heavy features, rather coarse; hair on head coarse and abundant, mixed with gray; terminates in a point at the middle of the forehead; eyebrows heavy; growth of hair on the upper lip over the malar surfaces and under the chin; this gives the patient a masculine appearance; axillary hair long and thick, pubic hair abundant, with distribution convex upward toward the umbilicus; dermatographia present; hips narrow and body angular in outline; hands are deformed from hard work; fingers spatulate; feet long and somewhat tapering.

*Gastro-intestinal.*—Tongue clean; many teeth missing; bowels regular; liver normal in outline; spleen palpable.

*Chest.*—Barrel-shaped; no adventitious sounds.

*Heart.*—Normal in outline; pulse-rate 70; blood pressure, systolic 116, diastolic 72.

*Mammæ.*—Well-developed and full; glands palpable in both axillæ. No retrosternal dullness.

*Gynecological.*—External genitalia normal; hymen ruptured; uterus rather infantile; menses regular.

*Reflexes.*—Both deep and superficial normal. Urinalysis negative; Wassermann with blood serum negative.

*Voice* coarse, heavy and deep.

*Mental.*—A case of imbecility with excitements. Is only interested in members of her own sex.

A state of pseudohermaphroditism dating from childhood with the outward appearance of masculinity due to an imperfect acquire-



CASE 9. General outline of body masculine in type; voice heavy and coarse; Hypertrichosis with male distribution. Some obesity.

ment of the secondary sex characters. Pluriglandular syndrome hirsute; masculine type of adiposity. Voice heavy and quite masculine in quality. Whole appearance shows positive maleness.

CASE 10. Obesity; general maleness in outline of the body; hypertrichosis.

M. B. Colored; age 50 when admitted in 1899; married.

Nothing known of family or personal history.

*Physical Examination.*—A very well-developed, well-nourished light-brown colored woman. *Eyes:* Right pupil widely dilated and inactive. Irides light brown. *Hair* gray, streaked with black, curled close to head. Muscles poor tone. Glands, bones and joints show no abnormalities.

*Digestive System and Abdominal Organs.*—Mouth: Not allowed to be examined. Appetite, digestion and bowels normal. Liver outline normal. Spleen and kidneys not palpable.

*Genito-urinary System.*—Examination not permitted.



CASE 10. Hypertrichosis, masculine type, deep voice.

*Respiratory System.*—Whole right side anteriorly shows slightly high-pitched note. Left side hyperresonant. No râles heard.

*Circulatory System.*—Heart outlines normal. Auscultation not satisfactory because patient talks constantly.

*Nervous System.*—Eye movements apparently normal. Vision,

smell, taste and hearing cannot be tested. Point of pin can be thrust deeply with very little response. No tenderness of muscles or nerves elicited. No vasomotor or trophic disturbances. No tremors or twitchings. Gait normal. No Romberg.

*Reflexes.*—Pupillary: Right pupil inactive. Left responds slowly to light and accommodation. Knee jerks and tendo-Achilles reflexes cannot be elicited. Other reflexes normal.

*Laboratory Findings.*—Urinalysis negative; Wassermann with blood serum negative.

She manifested the following symptoms of pseudo-hermaphroditism: Hypertrichosis over malar surfaces, chin and upper lip. Her general appearance approached the masculine type. She had a very heavy voice and in a deep monotonous tone constantly used profanity. She assumed a rather peculiar attitude with head bowed on the chest and arms folded, stood in one place on the ward; when anyone approached her or aroused her from her self musings she immediately attacked them, using boisterous profanity, or became violent towards them.

*Summary—Physical.*—Hypertrichosis over malar surfaces, chin and upper lip. Contour of the body masculine type. Voice heavy. Constantly reiterated profanity.

*Summary—Mental.*—Her general behavior was aggressive and domineering. She frequently assaulted anyone who approached her. She assumed rather a peculiar attitude, would stand around the ward for hours at a time or sit in the same chair and in the same location with her head bowed on her chest, arms folded, using profanity in a boisterous manner. Nothing is known of this case, nor of the onset of the psychosis, but it is included in the list because of the striking masculine appearance of this woman.

CASE II. Shows obesity, hypertrichosis.

E. K. Colored; aged 56 on admission in April, 1909; married.

*Family History.*—Mother died of a stroke of paralysis at 60 years.

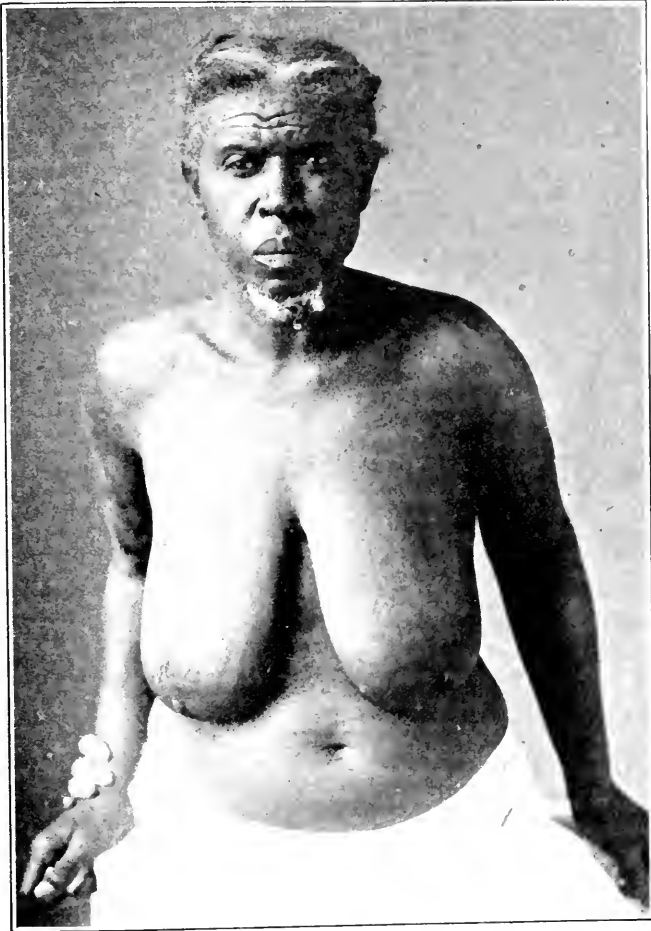
*Personal History.*—Born in Virginia before the war. No schooling. Had the usual childhood diseases. Married when 24. Had one miscarriage soon after marriage. Husband was addicted to alcohol, did not live with her regularly. Earned her living as a laundress. Was a patient in the State Hospital, Virginia, in 1903. Lived in Washington since 1907.

*Physical Examination.*—Height 5 ft. 3¼ inches, weight 153 lbs. Patient is fairly well nourished and shows no apparent deformities of bones or joints. Mucous membrane rather pale. Skin is very black and shows no areas of abnormal pigmentation, except over the breasts, where there are apparently healed scars of old excoriations. Hair fairly abundant on head, growing especially low on the temporal region. There is a considerable fringe of long, white hair on the patient's chin. They are sufficiently long and abundant for her to twist them together over the chin. No hair on upper lip. Hair rather scanty in axillæ, none on the nipples, moderately abundant on the pubis, where it rises in a triangle higher than normal on the



abdomen but shows transverse feminine distribution. Fingers tend to be long and slender, but are misshapen from hard work. Feet long and comparatively slender. Mammae very pendulous, hanging down to the abdomen, and are real large. Nipples are prominent.

*Abdomen.*—Marked protuberance, but abdomen is not pendulous.



CASE II. General appearance masculine; adiposity; hypertrichosis, male distribution; hands well formed, fingers long and slender.

*Head.*—No areas of cranial tenderness. *Eyes:* Arcus senilis present. Pupils small, round and contracted. No thyroid signs. *Ears* negative; lobes fairly well formed. *Nose* typical African, shows no apparent obstructions. *Mouth:* Teeth poor. Many missing. Palate rather high. Mucous membrane and pharynx normal.

*Glands.*—No fullness of thyroid or retrosternal dullness sug-

gestive of persistent thymus. Lymph glands palpable in each axilla. Several small, firm, discrete glands palpable in each groin.

*Chest.*—Lungs show an area of high-pitched breathing with a few crackling râles at the inferior angle of the left scapula. Heart shows mitral systolic murmur well heard over the precordium, but is not enlarged and is apparently compensating well for the lesion. Blood pressure—systolic 142, diastolic 84.

*Peric Examination.*—Labia minora long, lobulated and deeply pigmented. Outlet is narrow and admits only one finger. Nothing abnormal seen otherwise.

*Reflexes.*—Deep reflexes present. Abdominal and plantar could not be elicited. Pupils react to light and accommodation.

*Laboratory Findings.*—Urine negative. Wassermann with the blood negative.

*Mental Examination.*—State of depression on admission, later was excited, was hallucinated; the reaction was an excitement in an arteriosclerotic, probably of a manic-depressive type. She has had many periodic attacks of excitement.

*Summary.*—Adiposity with pendulous mammae hanging over the abdomen; configuration of the body masculine type; hypertrichosis of the face and the abdomen with male distribution rises in a triangle above the pubes; feet and hands long and slender, genitalia normal, but labia minora are very long. Little is known of the early history of this woman, but this case is included in the series owing to the physical evidence of pseudo-hermaphroditism.<sup>7</sup>

Here is a syndrome of unknown etiology, the chief symptomatology of which is the complete alteration of the secondary sex characteristics, and in some cases even the entire sexual characters during the developmental period, producing an anomalous biological individual approaching a hermaphroditic type; or this condition may be termed a form of pseudohermaphroditism.

Now to what fundamental cause is this abnormality of the sex-ensemble due? Quinby<sup>8</sup> reports a case of female pseudohermaphroditism of the external type showing an unusual accentuation of the secondary sex characters of the male, and says: "Judging from the literature, such cases present an endocrinopathy of the adrenal cortex, surely; possibly also of the pituitary body."

In the group here presented the patients show a definite conformity to a certain individual type which has long been recognized as a distinct classical group. It is often referred to as the Leonardesque character and the idealization of the human form by artists often follows this type. This is illustrated in the Da Vinci's madonnas, and especially in his painting Mona Lisa, in which the facies as well as the graceful hand is distinctly of this class. Even his self-

<sup>7</sup> The writer is indebted to Dr. Edward J. Kempf for many valuable suggestions in this paper.

<sup>8</sup> Quinby, Wm. C., Bulletin Johns Hopkins Hospital, February, 1916.

portrait in the Uffizi Gallery shows physical peculiarities suggesting that Da Vinci himself was possibly an endocrinopath.

In reviewing, the most important symptoms of this definite clinical syndrome may be summarized as follows:

First. There is a deviation of the anatomical configuration of the body, including to a degree a faulty skeletal development. The outline of the body assumes a male habitus; in many of these women the pelvis is narrow and the body has a more or less angular appearance. The voice is heavy and coarse; the features are regular and symmetrical, but atypical. The individual may be taken for either sex, depending upon the drapery. The most striking deviation in the bony growth is observed in the shape of the hands and feet, which, in the majority of the cases, are small, delicate and well formed, the fingers tapering. This type of hand has been fully discussed in connection with diseases of the pituitary body and is supposed to be due to a perverted functioning of this organ, as well as of some of the other endocrinous glands. Penda<sup>9</sup> discusses this hand in full, as follows: "In regard to the hand sometimes it grows unnaturally broad, because of the hypertrophy of the integument and of excessive ostogenesis (the broad hand of acromegaly); sometimes, on the contrary, the hands are of gigantic size in both breadth and length (the long hand of gigantism) in which, however, the transverse diameter exceeds the longitudinal. But hands are also sometimes observed of particularly delicate growth, conic in form, with slender phalanges, and gracefully pointed at the ends of the fingers. Hands of this form are usually met with in certain states of hypofunctioning of the hypophysis in youth; in patients suffering from hyperthyroidism of Basedow, in which there is a primitive precocious genital insufficiency, as also in the condition of thymico-lymphaticus a long slender hand is observed, but the length may sometimes be disguised by an excessive layer of adipose tissue." Cushing<sup>10</sup> also refers to these two types of hands and contrasts them with the "*type en long*" of gigantism and the "*type en large*" of acromegaly described by Marie. Barker<sup>11</sup> also mentions this peculiarity of bony conformation of the hand as "gracile," the "fingers tapering." Evidently the bony growth of the body depends upon not only one but several of the endocrinous organs and their normal functioning.

Second. The abnormalities in the general contour of the body

<sup>9</sup> Penda. *Endocrinologia patologica e clinica degli organi e secrezione interne.*

<sup>10</sup> Cushing, Harvey. *The Pituitary Body and Its Disorders.*

<sup>11</sup> Barker, Lewellys F. *Monographic Medicine*, Vol.

are only partly caused by the anatomical changes in the bony framework, for, in addition, the skin is smooth and coarse as a rule; the musculature in some cases is vigorous, for the obesity, which is included in the soft structures, is one of the most prominent and frequent symptoms in all of the cases. Several of these patients manifested this symptom in infancy, in others it existed since childhood, and yet in others it appeared in the adolescent period. In fact, this symptom appeared previous to the menopause in all of the cases where it was possible to obtain a history. Adiposity due to derangement in the functioning of the organs of internal secretions has received considerable attention and forms of this syndrome have been described due to underfunctioning of the following glands, hypophysis, thyroid, genital glands, each of which has its own individual identity; this symptom occurring in these patients is in striking contrast to the classic picture known as *typus Fröhlich*, in which the obesity is associated with lack of development of the secondary sex characters and is designated as *hypophyseal dystrophia adiposogenitalis*.

Third. A disturbance of the pilous system. Here there is an excessive development of strong, coarse hair where ordinarily in women there is merely a light down, soft and nearly invisible. This hypertrichosis does not make its appearance coincident with an excessive development of hair on the head, but is especially localized on those parts of the body where on males there is a hirsute growth. On the face a heavy beard develops, which, contrasting with the smoothness of the skin, lends emphasis to the masculine appearance of the individual. Besides the beard and mustache there is a heavy growth of hair on the body, distributed in a manner closely resembling the topography of hair on the male; instead of the hair on the pubes having the transverse distribution of the female it rises to a point extending toward the umbilicus. This disposition of hair on the body differs from that of the hypertrichosis of the involution period and the presenile state, which is accompanied with a thinning of the hair on the head, pubis and axillæ, and other evidences of senescence.

To this abnormal anatomical condition of the hair there has been attributed an hereditary element. In two of these patients it was possible to trace a family disposition to a derangement of the pilous system. Numbers 3 and 5 gave a history of a paternal aunt in each case having had this symptom. The etiology of hirsutism is attributed to a hyperfunctioning of the gonads, as well as to a derangement of secretions of the cortex of the interrenal glands.

But it is probable that several of the endocrinal glands are also involved in this disturbance of function.

Fourth. Disturbance of the genital function: The genital anomalies are disturbances of menstruation and of the secondary sex characters which resemble those of the opposite sex. In these cases the irregularities of menstruation noted vary to quite a marked degree and consist of early menses, delay in establishing the menses, arrest of this function with amenorrhea extending over a period of years. There is little evidence of somatic anomalies in the primary sex characters in this group of cases; in one patient an infantile uterus was discovered and in several others there were some slight anomalous conditions observed in the external genitalia, but aside from these there was no physical stigmata to indicate a hermaphroditic condition, anatomically or functionally, of the pelvic organs.

In some of the cases which could be traced from childhood through the developmental period the sexual instincts and inclinations seemed to have exhibited, subsequent to the pubertal period, sexual bivalency, that is, the patients appeared to have the components of both sexes which were unequally divided, the male sex predominating, and yet, in early childhood some of these cases displayed a homosexual inclination. Where the early history was unobtainable the classification into this series was principally made from the physical manifestations and the outward behavior and conduct of the individuals.

Fifth. In the mental phenomena of this syndrome there is evidence of disturbance of the psycho-sexual development—psychic hermaphroditism. In the majority of the cases there is a peculiar anomalous condition of the sexual instinct and inclination, which does not correspond to the sex represented by the individual, physiologically and anatomically. These abnormal manifestations correspond to stages of sexual evolution, as recognized by modern science. There is a distinct manifestation of abnormal sexual instincts—there appears to be a predominating homosexuality with periodic reversals of the sexual inclinations and instinct and impulses toward the same sex; namely, psychosexual hermaphroditism. Some of the women possess insight as to these contrary sexual feelings and have a consciousness of the abnormality of the manifestation. These psychical anomalies are displayed in the behavior of the individuals and in the content of their mentally disordered thought and dissociation of ideas which is the expression of their unconscious strivings. In some of the patients, especially where there are the manic-depressive reactions, there appears to be a bisexualanlage. In case 3 the

patient is homosexual in the depressed stage of the psychosis and heterosexual in the excited phase. Cases 4 and 6 both show this fluctuating sexuality; in the depressed stage both are homosexual; while in the excited stages the sexual cravings are decidedly heterosexual. Cases 3 and 4 have a clear critique of this anomalous sexual inclination and have explained this abnormal mode of feeling, for there appears to be a struggle between the male and female elements at times but usually one overcomes the other. This psychic hermaphroditism is obviously rather common in the manic-depressive reaction of psychosis, as the writer has observed numerous cases in which the sexuality varied in the individual from homosexuality in one stage to heterosexuality in the other quite independent of any other hermaphroditic features. In the dementia præcox reaction types the impulses and inclinations were decidedly homosexual and were revealed psychopathologically in a concrete form, or symbolically by the mental productivity and the conduct.

There is no definite mental reaction type associated with the endocrinopathies; the characterological makeup of the individual determines the psychological conflict and this conflict decides whether the individual will be introverted or extroverted and hence whether the mental mechanism will be of the præcox, manic-depressive, or other type of reaction.

Here is a group of individuals, by no means exceptional, showing clinical evidence of pseudohermaphroditism of the external type, which is manifested in the secondary sexual characters and in the mental processes. With the present knowledge of growth and metabolism there is difficulty in demonstrating or deciding the interpretation of this syndrome of variant symptoms. It is believed that the direct action of the chemical products of the gonads, through the nervous system, influences the growth and metabolism of every tissue in the body but how much this action is increased or inhibited by the chemical products of the other endocrinous organs is as yet unknown. The knowledge we possess on growth, development and nutrition shows that there is a chemical regulation as well as nervous regulation in the processes that control metabolism and that the action between these systems is reciprocal. There is reason to believe that the key to the solution of these problems will be found in the vegetative nervous system.

After briefly reviewing what is known of the interrelationship of the endocrinous glands Jelliffe and White<sup>12</sup> conclude: "Just as the complicated sensori-motor integrations are effective in governing

<sup>12</sup> Jelliffe and White. *Diseases of the Nervous System*. 2d Edit. 1917.

the muscular activities of the body, so the integration of the neuro-chemical regulators, taking place at the physico-chemical level, is effective in adjusting the metabolism of the body cells. Hormones are not the activators primarily; they are the servants of the vegetative nervous system. All of the endocrinopathies are really polyglandular syndromes and are under psychical control."

This is a polyglandular syndrome, but whether it is due to glandular insufficiencies or overactivities is a subject for discussion. The various efforts that have been put forth to interpret the interrelationship and to correlate the knowledge have made great advancement in recent years. There remains however a great unexplored field for future research to determine the etiological factor that produces the disharmony in the biological relations of the elements that control bodily metabolism.

# AN ANALYSIS OF THE ACTION OF MORPHINE UPON THE VEGETATIVE NERVOUS SYSTEM OF MAN\*

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## PART I: THE ACTION OF MORPHINE

Although the alkaloid, morphine, has been known for over a century, and was, in fact, the second to be isolated, we have not as yet any precise knowledge of its *general action* upon the nerves which control visceral organs, and upon which it acts. With its effect upon the functions of these organs we are, in the main, very familiar. Before giving this general action detailed description, a brief resumé of the main characteristics of the vegetative nervous system will be considered.

During the last two decades, the pharmacologists and physiologists have crystallized from the mass of knowledge concerning the "sympathetic" system, a scheme the value of which, for every branch of medicine, can scarcely be overestimated. This scheme involves all that part of the nervous system which supplies smooth muscle, glands and blood vessels. It is the entire nervous system, exclusive of the sensori-motor system, which subserves sensation and voluntary motor functions. By various means, anatomic, physiologic, and pharmacologic, we have come to understand certain features of this new conception, which is known as the vegetative nervous system. Pharmacology and physiology have shown that it is made up of two antagonistically acting parts.

These parts are now called the sympathetic on one hand, the autonomic on the other.

The sympathetic centers in the spinal cord lie exclusively in the thoraco-lumbar region. Their anatomy may be seen by the dotted markings in the accompanying diagram (Fig. 1).

The autonomic centers lie in the mid-brain, medulla, and sacral parts of the spinal cord. This may be seen by the undotted markings in the diagram.

On the physiologic side, we find that electrical stimulation of the various branches of the two systems proves their antagonism. Since

\* Preliminary Report New York Neurological Society, February 7, 1915.



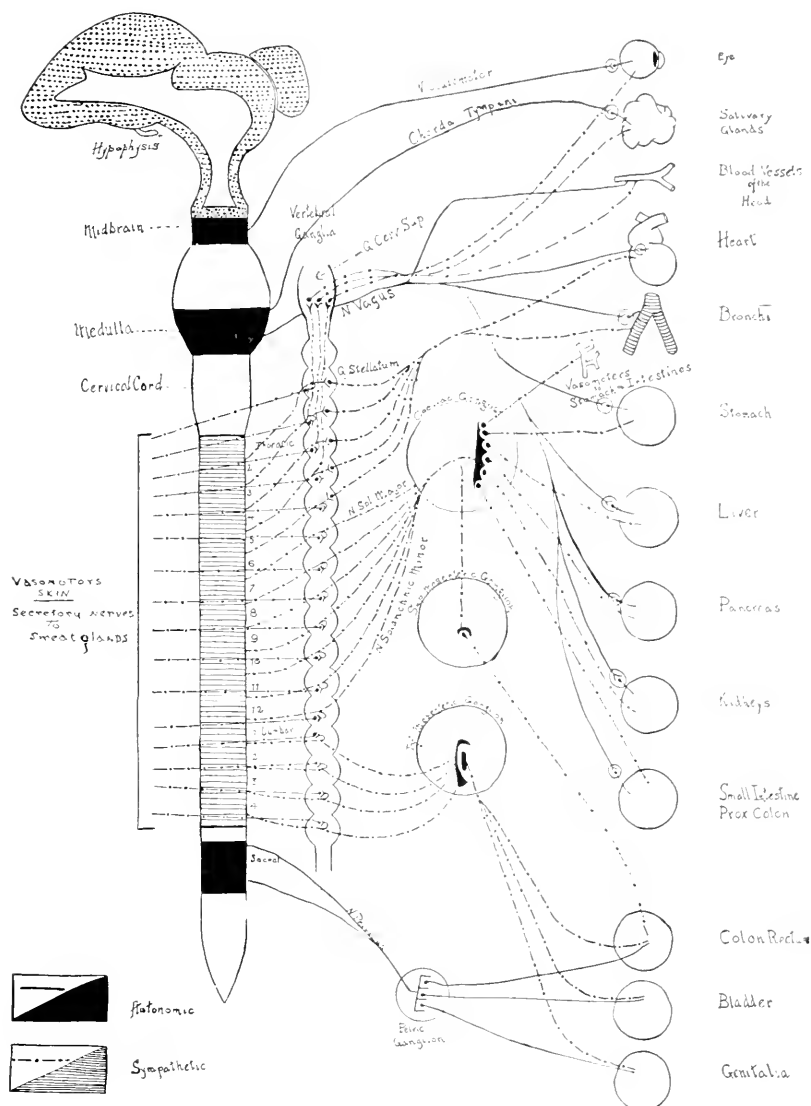


FIG. 1. Distribution of the various divisions of the vegetative nervous system. Sympathetic pathways in dotted lines, Autonomic in unbroken lines. (Jelliffe and White.)

every organ is supplied with nerves from each of the two systems, and since they are antagonistic, it naturally follows that the activity of any particular organ will be increased or decreased by the electrical stimulus, depending on which system is stimulated, and whether the fiber acted upon is inhibitor or accelerator.

It is difficult indeed to imagine a more irksome task than learning the pharmacological action of the various drugs which we use, without any systematic basis to simplify our efforts. The advent of this knowledge of the vegetative nervous system has made the problem simpler not only academically, but also clinically. It has been found that many alkaloids have a site of action which is quite specific, and an action which is very orderly. Let us take the classical example, adrenalin. This substance acts upon all the peripheral endings of the sympathetic system. Chloral hydrate paralyzes the central sympathetic endings. Cocaine acts as a catalyzer of the activity of the peripheral endings of the sympathetic system, *i. e.*, it makes stimuli have a greater action, though it does not of itself act as a stimulant.

Atropine paralyzes the peripheral endings of the autonomic system. Pilocarpine, on the other hand, stimulates them, as does muscarine. Many other examples could be given.

The activity of a drug which acts upon the vegetative nervous system is to be considered from at least four aspects.

1. The site of its action, central, ganglionic, or peripheral.
2. The action upon the vegetative nervous system; is it autonomic or sympathetic? Does it stimulate, catalyze, or paralyze? Does it affect accelerators or inhibitors, or both? Does it affect secretory (pilocarpine) or motor fibers, or both (atropine)? Does it affect one nerve, as for example the vagus or pelvic, more than another?
3. The effect of the action upon the activity of end-organs. Is their activity increased or decreased?
4. The effect of the action upon the function of end-organs. Is this augmented or diminished?

#### THE ACTION OF MORPHINE

We shall, at the very outset of our discussion, state what we believe to be the action of morphine; and in the pages to follow shall cite the proofs.

1. The site of the action of morphine is believed to be in the central sympathetic inhibitory mechanism, acting on the autonomic.
2. The action of morphine upon the vegetative nervous system

of man may be divided into two stages: the first stage is that of stimulation of accelerator action and of depression of inhibitor action; the second stage is that of depression of accelerator action and stimulation of inhibitory action; a third stage is the result of depression, ending in paralysis of inhibitory action. This action upon inhibitory function applies to the reflex activities of the voluntary motor part of the spinal cord.

3. The activity of the muscular elements of the eye, the gastrointestinal tract, and the bladder is increased. All other muscular activity is diminished. Secretory activity is diminished.

4. The effect of the action of morphine upon function in the first stage is excitation. The effect in the second stage is depression. In the third stage the effect upon inhibitory action, as far as vegetative functions are concerned, causes a cessation of their activity. The third-stage effect upon the reflex activities of the voluntary motor part of the spinal cord is depression ending in paralysis of inhibition, which permits the reflex irritability of the spinal cord to increase.

In adults the first stage in man is either absent or very transient, except in those having an idiosyncrasy to morphine; the second stage is that of therapeutic dosage; the third stage is very rarely reached in man, due to the fact that the respiratory function becomes paralyzed at the end of the second stage and causes death. The third stage may be obtained in dogs by keeping up respiration artificially.

In children, the well-known relative inactivity of cerebral inhibition permits the third stage to make its appearance more frequently.

The following table compares the various actions of morphine with the action of certain drugs upon the sympathetic and autonomic nervous systems (Chart 2).

It will be seen that two columns under morphine express a very interesting fact concerning it: viz., that in some organs and functions there is a great difference between its action and the effect of its action. For example: Though there is slowing of the heart rate, decreased activity, there is a rise in the vagus tone, increased nerve activity. Column two shows the changes produced by morphine, illustrating its general depressant action upon function.

Two actions in the chart will probably strike the reader as anomalous. These are the actions upon the eye and bladder. This anomaly is only apparent, and will be shown so in the section upon these organs.

CHART 2

Organ	Morphine		Withdrawal Symptoms	Effect of Withdrawal Upon Functions	Effect of Action of Atropine as Autonomic		Synergism between Atropin and Morphine		Action of Accessory Drugs and Treatment
	Action Upon Autonomic Functions	Effect of Action Upon Functions			Stimulant, First Stage	Paralysant, Second Stage	First Stage	Second Stage	
1. Pupil.....	S	D	Accommodation paresis mydriasis ...	S	D	S		+	No reading.
2. Bronchial musculature....	D	D	Asthma .....	S	S	D		+	Stopped before danger point is reached.
3. Heart .....	S	D	Tachycardia ...	S	D	S			<i>Vigorous Catharsis:</i>
4. Gastro intestinal muscle.	D	D	Vomiting, diarrhoea ....	S	S	D		+	1. Compound cathartic pills.
5. Biliary muscle.....	D	D	Colic .....	S	S	D		+	2. Blue mass.
6. Uteral muscle.....	D	D	Colic .....	S	S	D		+	3. Magnesium sulphate.
7. Bladder muscle.....	D	D	Contraction	S	S	D		+	4. Soap suds enemata.
8. Uterine muscle .....	D	D	pains.....	S	S	D			Nitrites; hot baths; alcohol rubs.
9. Vasomotors .....	S	D	Pains in extremities ..	S	S	D		+	(Vasodilatation.)
10. Lachrymal secretion....	D	D	Epiphora.....	S	S	D		+	
11. Salivary secretion .....	D	D	Salivation.....	S	S	D		+	
12. Secretions of nose and mouth.....	D	D		S	S	D		+	
13. Bronchial secretion .....	D	D	Coryza.....	S	S	D		+	
14. Gastro-intestinal secretion .....	D	D	Increased .....	S	S	D		+	
15. Pancreatic secretion....	D	D	Diarrhea .....	S	S	D		+	
16. Biliary secretion .....	D	D		S	S	D		+	
17. Dermal secretion.....	D	D	Hyperidrosis....	S	S	D		+	
18. Blood pressure.....	S	D	Lowered*.....	S	D	S		+	
19. Respiration .....	S	D	Tachypnea .....	S	D	S		+	
20. Temperature .....	S	D	No great change	S	D	S		+	

\* Due to the increased heart rate with enfeebled force of contraction.

THE ACTION OF MORPHINE UPON THE VEGETATIVE CONTROL<sup>1</sup> OF ORGANS, THE ORGANS THEMSELVES, AND THEIR FUNCTIONS

*Smooth Muscle.*—The bronchial musculature is contracted by the vagus nerve. The depressant effect of morphine upon this accelerator action is shown in the benefit derived from the use of morphine in bronchial spasm. Osler (1), in considering the various methods of treatment of bronchial asthma, states, "More permanent relief is given by the hypodermic injection of morphia and strychnia combined."

The action of morphine is (1) to depress an accelerator nerve; (2) diminish muscle activity; (3) decrease functional activity.<sup>2</sup>

The effect of the action of morphine upon the heart is well known: the slow, steady, strong vagus pulse. Experimentally, a preliminary tachycardiac phase, very brief in duration, has been demonstrated. This is the first-stage action, the bradycardiac being the second. Electrocardiographically, Einthoven and Wiering (2) showed that vagus stimulation by morphine caused heart block, which could be stopped by atropin or vagotomy.

The effect of the action of morphine is thus seen to be: (1) stimulation of an inhibitory nerve; (2) depression of muscular activity; (3) depression of function.

The effect of morphine upon the organically diseased heart is not always depression of the function, but, on the contrary, increase of function. Specially is this the case in many instances of decompensation. The activities of morphine in pathological conditions will receive attention in another place.

The effect of the action of morphine upon vascular muscle is to diminish its activity (vasodilatation) in the face area. An appreciable general action is obtained by slightly larger than therapeutic doses. This action of morphine is utilized to aid the action of diaphoretics. The interrelations of vaso-motor activity, cardiac activity, and blood pressure are such that the action of therapeutic doses of morphine is not clear-cut all over the body, except in the case of the heart. When larger doses are given, or when a habit has been formed, vasodilatation, low blood pressure, and bradycardia

<sup>1</sup> The details of the effect of the action of morphine upon vegetative nerves is worked out on the assumption that the statement just made is correct. Whether this assumption be correct or not does not alter the conclusions, namely, that the action of morphine in terms of the V. N. S. is an orderly one. A criticism of the assumption will be found in the Summary.

<sup>2</sup> This is not the case when the muscle is pathologically contracted but is so when the normal state of contraction is depressed. It may also be said that increase of the normal state of contraction is also depression of function. Parallely, atony and spasm of the intestine are both depression of function. What seems true is that relaxation of the bronchial musculature diminishes its function.

are all present. The two former are examples of depression of accelerator functions, for vasoconstriction and a rise of blood pressure are to be counted among these.

The physiology of the stomach is in many respects obscure, in spite of the large amount of work which has been done. There is the usual double control by chemical and nervous activities. The latter is distinctly triple in nature, consisting of the vagus, the splanchnic, and the intrinsic system or "enteric system" of Langley. The action of one of these three nerve supplies is fairly clear. This is the splanchnic, which acts as an inhibitor to the activities of the other two systems. The vagus, on the other hand, exerts an accelerator action, increasing the activities of the system. But the enteric system also has the function of initiating movements under proper conditions, and it is this which has given rise to considerable confusion and obscurity.

Morphine produces several conditions which are regularly found by X-ray examination. (1) Peristaltic waves passing from the cardiac end of the stomach toward the fundus, and then on to the antrum pylori; (2) spasm of the sphincter antri pylori; (3) waves of peristalsis noticeable in the antrum itself; (4) closure of the pyloric sphincter; (5) diminution of the secretion of gastric juice.

This action is complex. The effect of the action is to retard the passage of the food into the antrum, and thus into the duodenum, for a considerable time.

A consideration of the stomach (1) when morphine is used, and, for contrast, (2) when the vagus is stimulated will throw much light on the morphine action. The stomach is concerned primarily with the function of containing the food ingested. This is, indeed, of the nature of a progressive function, since it must act so as to allow the stomach to contain successive portions of ingesta. Anything which causes a stoppage in the exodus of food will very naturally impair this function just as a spasm of the sphincter of the urinary bladder, or an obstruction at the orifice of the gall bladder will cause diminution of the container function of these organs.

The next function of importance is that of propulsion. The stomach is needed to send the ingesta onward. The slow peristaltic waves of band-like constriction in the fundus, and the more stormy action of the antrum pylori subserve this function in part. The third function, disintegration, is subserved by the antrum pylori, whose activities serve to churn up the food and divide it into small parts.

Finally, the fourth function, secretion. This is of great impor-

tance, not only for the purpose of rendering certain parts of the food absorbable, but also to regulate the movements of the sphincter pylori. Vagus stimulation causes a great increase in peristaltic activity; the food is rushed through the stomach into the duodenum; the rate of opening and closing of the pyloric sphincter is much increased, as is the precurrent function of disintegration. It might be thought that the increase of hydrochloric acid would cause a sphincter spasm at the pyloro-duodenal junction, but it may readily be seen that the alkaline duodenal secretion is also increased, thus effectively neutralizing the increased hydrochloric acid.

We see, therefore, that the action of the vagus is complete furtherance of the functions of the stomach, secretory, propulsor, disintegrator and container.

When under the influence of morphine the secretory function is diminished. The function of container is also diminished, for the spasm of the sphincter antri pylori causes the fundus to remain full, thus preventing addition of more ingesta. The function of propulsion is diminished, for there is not enough hydrochloric acid to open the pyloric sphincter effectually, and the retention of food in the comparatively inactive fundus adds to this inertia. The function of disintegration is diminished because, in the first place, there is but little ingesta passing the spastically shut antral sphincter and, secondly, because there is not the normal amount of moisture from gastric secretion. What results is an abnormal liquefaction as occurs in pathological retention, instead of normal disintegration.

For the purpose of clearness we have put these various actions in tabular form (Fig. 3).

FIG. 3  
*Gastric Functions*

Function	Morphine	Vagus Stim.
Secretory .....	—	+
Propulsor .....	—	+
Container .....	—	+
Disintegrator .....	—	+

It is thus seen that morphine has the same action as elsewhere, (1) it depresses an accelerator nerve action, viz., that of the vagus nerve. The effect of its action is at the same time activity and depression; (2) muscular activity; and (3) functional depression.

The action of morphine upon the intestine is to diminish its activity, both muscular and glandular. The passage of food or a bismuth meal is delayed to a great extent. The effect of the action follows the same principles as were described for the stomach. The furthering action of the vagus nerve is removed. An accelerator

action is diminished. The work of many investigators, among whom may be mentioned: Magnus (5), Van der Velden (6), and Mahlo (7), serves to show this.

The beneficial effect of morphine in renal colic (ureter muscle) is familiar. Morphine acts by reducing the activity of the vagus nerve, *i. e.*, depresses accelerator function.

The same applies to the gall-ducts upon which morphine also acts as a depressant to the vagal activity, a depressant to muscle activity, and a depressant of function.

The effect of the action of morphine upon the uterus is sedative. The following quotation serves to emphasize this.

"Treatment of threatened abortion: Whenever symptoms of threatened abortion appear, the patients should be placed in bed and kept in a recumbent position. If pains occur, a hypodermic injection of  $\frac{1}{2}$  grain of morphine should be administered at once, to be followed by one grain rectal suppositories of extract of opium, repeated at intervals of every four or six hours" (8).

The stimulative action of the autonomic pelvic nerve upon the uterine muscular activity is apparently diminished. Moreover, were the effect other than described, the end results would not coincide with the clinical findings.

The subject of menstruation will be considered later.

The urinary bladder is composed of two muscles, the detrusor and the sphincter. The nerve supply of these two muscles is derived from the pelvic nerve (autonomic) on one hand, from the hypogastric (sympathetic) on the other. The pelvic nerve stimulates the detrusor, depresses the sphincter. The hypogastric nerve does the reverse.

The functions of the bladder are: (1) container, (2) excretor. If the pelvic nerve be overactive, these functions are increased. The bladder, being emptied more readily, may receive and contain more urine. Excretion is obviously promoted.

The functions of the bladder are controlled by the centers in the sacral and lumbar spinal cord, the former increasing its functions, the latter diminishing it. The effect of the action of morphine is to stimulate the sphincter to contraction, this contraction passing on to spasm in acute poisoning. (In rabbits this acute retention may lead to rupture of the bladder and death therefrom.) The dangers of this spasm are increased by the analgesia which morphine produces.

Thus morphine diminishes the functions of the bladder, though the effect of the action is stimulation. The action is central, and



since the pelvic nerve is accelerator, there is obviously a depression of accelerator action. The difference between central action and peripheral effect recalls that existing in the eye and gastro-intestinal tract, where central depression produces peripheral activity equivalent to functional depression.

It is important to recall that the action of morphine is to destroy the mechanism of bladder control. *This interference with central control is found in all the visceral actions of morphine.*

The activity of the pupil is governed by a center. This center influences both the sympathetic fibers and the autonomic fibers so that a coördination of the two results. When there is any sensory stimulation, *i. e.*, excitation, excepting that of light, the pupil dilates. On the other hand, in sleep, a state of depression, or absence of stimulation, the pupil contracts. This action has been ascribed to a lack of the normal sensory stimuli. If stimuli are given to a sleeping person, the pupil dilates, and about in proportion to the stimulus. The pupil is not in its usual active state during sleep; it is in a state akin to bodily depression. Chloral hydrate produces the same effect. Since the normal stimuli of waking hours stimulates the sympathetic (dilatation), in sleep this disappears. The coördinating mechanism must be of a similar nature to that governing the actions of the agonists and antagonists in voluntary muscle activity; that is, there is a mutual central inhibitory mechanism. When the eye contracts in sleep, it follows, since this is maximum, that the sympathetic inhibition of the autonomic constrictor fibers must be inactive. Thus we see that morphine in producing myosis does the same, for its action is central and must be either upon the constrictors or upon their sympathetic inhibitors.

The autonomic fibers are depressors. It is probable that they are stimulated in morphine myosis through the elimination of central inhibition.

It might be urged that constriction of the pupil is not depression, since it occurs on accommodation to near objects, and on reacting to light. However, there seems no good reason to believe that the action of seeing distant objects should be considered as the cause of depression of pupillary function any more than the act of seeing near objects.

If one observe pupillary activity under the influence of stimulation, excitement, it is noticed that the pupil dilates. When, however, there is no abnormal stimulus, it remains in normal balance. When there are no stimuli, it constricts to the maximum (sleep). *Thus it is reasonable to conclude that dilatation is equivalent to excitation, constriction to depression.*

Considering the light-receiving function, we find a similar state of affairs. When the pupil is dilated, this function is at its maximum, that is, more light reaches the retina.

Looking at the question from the point of view of muscle activity, both acts are the expression of increased activity. The coördination mechanism comes into play in both. But in the pin-point pupil caused by morphine, obviously one part of the coördinating mechanism is overcome by the other.

It seems justifiable to conclude that morphine acts upon the pupil as it does elsewhere in the body. It stimulates a depressor activity and thus causes depression of function, though this occurs, as in the case of the gastro-intestinal tract and bladder, through increased muscular activity.

*Secretions.*—The effect of morphine in therapeutic doses upon the lachrymal secretion has scarcely received enough notice to warrant any conclusions. However, the condition in chronic morphinism leads to rather definite conclusions. When the drug is withdrawn, marked lachrymation occurs, which ceases if the drug be administered. Observations upon chronic morphinism and the withdrawal symptoms will receive attention in Part II, but we wish to state, here, that the evidence just given shows that morphine will depress the activity of the accelerator autonomic fibers to the lachrymal gland.

A considerable amount of work has been done which shows that morphine depresses the gastric secretion for a varying length of time, dependent upon dosage. This time varies between one half and four hours. Then there follows a period of hypersecretion. This is probably initiated by the passage of food into the duodenum after the morphine action is gone, as well as being a compensatory mechanism. Both factors play a part. Riedel (9) and Cohnheim and Modrakowski (10) have shown these relations to be true. Thus an accelerator action is decreased by morphine.

Cohnheim and Modrakowski (10) have shown that the secretory activity of the pancreas, which is increased by vagal stimulation, is decreased by morphine. The action of morphine is depression of an accelerator nerve, of gland activity and of functional activity.

There has been very little done upon the subject of renal secretion. In fact, the text-books give us no clear-cut information as to the effect of morphine. Hewitt (11) states that "it is questionable whether the time-honored custom of withholding morphine, even in very small doses, when renal disease is present, is one which need be followed on all occasions. If, however, any tendency toward uremic coma should exist, it would not, of course, be wise to use

this drug." Cushny (12) states that "the urine does not generally show any distinct alteration after morphine in man." Glycosuria may occur. In diabetes the glycosuria is decreased, possibly due to a combination of general depressor action upon metabolism with the depression of gastro-intestinal activity.

In view of the paucity of information we must leave the matter as it stands, reserving the privilege of calling attention to the depressing effect in preuremic states.

The behavior of the sweat apparatus is the black sheep in the flock of vegetative activities. Electrical stimulation of the sympathetic nerve causes sweating, while adrenalin produces the reverse. Pilocarpine is a well-known diaphoretic. Morphine in therapeutic doses causes mild sweating, contrary to its action on all other secretions. However, the evidence of chronic morphinism is more convincing of the uniformity of the action of morphine. Here we get a very dry skin. On withdrawal there is marked sweating, not the mild perspiration resulting from therapeutic doses of morphine. It would seem, therefore, that here also morphine inhibits an accelerator action. The anomalous action in small doses is due to vasodilatation, not to diaphoresis.

The regulation of temperature is by means of two central mechanisms, a thermogenic and a thermolytic. Recently, H. H. Meyer (13) of Vienna, by summarizing the knowledge at hand up to date, has concluded that the thermogenic center is sympathetic in nature, the thermolytic center, autonomic.

These centers are changed both in activity and reactivity during fever. The reactivity is increased, the environment producing more changes than it normally would, while the activity is changed in such a way as to render the thermogenic center more active, the thermolytic less so.

Morphine reduces the temperature in acute poisoning (large doses) and in pneumonia. The former is familiar. The drop may be 2° F. The latter was shown by Van der Velden (14), where therapeutic doses were given (gr.  $\frac{1}{4}$  to  $\frac{3}{10}$  caused a change of from 1.6° to 3.2° F.). In chronic morphinism, less of the drug is needed to keep some patients with fever comfortable than they require when they have no fever. Apparently, therefore, morphine depresses an accelerator function when (1) large doses are given (acute poisoning); (2) when the activity of the function is increased. (Pneumonia, chronic morphinism with fever.)

Morphine is the best respiratory paralyzant we know. Atropine, on the other hand, is a splendid respiratory stimulant, its action

being central. This central action is quite in accord with its peripheral actions, since these, by causing autonomic paralysis, permit the activities of the sympathetic to have full sway. Increased respiratory rate coincides with general sympathetic activity (fever, fear), and since it is centrally depressed by morphine, the action is a depression of an accelerator function.

It has been noted in the introduction that morphine stimulates inhibition of the reactivity of the spinal-cord motor elements, and that this action may go on to paralysis, in which case there is a rise in the reactivity of the motor-cord elements with convulsions. The degree to which this action progresses depends, of course, upon the resistance of the cerebral functions, as is shown by the greater likelihood of convulsions in children. The reason for this is that the cerebral control is less in them than in adults.

The sensation of pain is certainly received by stimulatory action, and the depression of this by morphine is most familiar. To go further into the subject of cerebral functions is scarcely possible at this writing.

#### SITE OF THE ACTION OF MORPHINE

*The effect of the action of morphine upon the vegetative nerves may best be expressed as depression of the accelerators and stimulation of inhibitors. The site of its action is believed to be the central sympathetic inhibiting-mechanism acting upon the autonomic, but the proof is inadequate at present.*

#### CONCLUSIONS

1. From the preceding it may be stated that the action of morphine is bifold. The first stage consists of depression of inhibitory activities, stimulation of accelerator activities. The second stage consists in stimulation of inhibitory activities, depression of accelerator activities.

2. The most noticeable effects of the action of morphine are those of the second stage. This is due to the transitory nature of the first stage. In certain individuals, this first stage may be unusually long. On the other hand, it may be practically absent.

3. The effect of the action upon function is depression.

4. The effect of the action upon visceral activity in some cases is increased muscular activity, as in the eye, gastro-intestinal tract and bladder.

5. The site of the action is believed to be central, and upon the central sympathetic inhibitory control of the autonomic centers.

6. The action of morphine upon pain sensation is a depression of a stimulatory action, according with its other actions.

*Note.*—The confirmatory evidence which chronic morphinism, and particularly the withdrawal symptoms, bring to bear upon the above conclusions will be discussed in Part II.

## PART II: WITHDRAWAL SYMPTOMS OF CHRONIC MORPHINISM

On May 23, 1914, an editorial upon withdrawal symptoms of chronic morphinism appeared in the Journal of the American Medical Association stating: "Despite the interesting facts which have developed in the past decade or more concerning the underlying features of chronic morphinism, a number of phenomena have been left unexplained." Referring to Rübsamen's work on the gradual immunization of rats to morphine, the editorial continues: "Important as these aspects of the continued use of morphine doubtless are for an understanding of the altered physiologic conditions it produces, they furnish no clue to an added feature which must be taken into account in practice. *The sudden withdrawal of the drug does not result merely in negative symptoms, but often produces such intense misery and depression as to indicate actual danger. There are positive manifestations which it is difficult to explain solely by the lack of the narcotic, so that something more than the mere staying of the craving appears to be necessary.*"

The object of this paper is to explain the cause of the nature of the symptoms of withdrawal in chronic morphinism. Briefly summarized, the symptoms are simply the opposite to those produced by the action of morphine.

*The reason that any vegetative symptoms appear is that, in the course of acquiring an increased tolerance to the drug, the threshold of irritability of the vegetative nervous system is gradually raised. Were this not so, two things would happen: there would be continual occurrence of symptoms while the drug was used in tolerated doses, and there would be no symptoms upon withdrawal.*

As has been shown in the first part of this paper, morphine causes functional depression. A glance at the table of signs and symptoms (Fig. 4) of morphine withdrawal, chronic morphinism and acute morphine administration will show that the symptoms of withdrawal are the opposite of morphine administration and chronic morphinism, *i. e.*, functional acceleration.<sup>3</sup>

<sup>3</sup> Confirmation of our own observations has been obtained in references 15 to 25 (see list).

Fig. 4.

Action of Withdrawal Upon Cen- tral Sym- ptomatic	Action of Withdrawal Upon Autonomic	Effect of Withdrawal	Symptoms of With- drawal of Morphine	Organ or Function	Symptoms of Morphine Administration	Effect of Action of Morphine	Action on Autonomic	Action of Morphine Upon Sym- ptomatic Central In- hibitors	Autonomic Action, Accelerator and Inhibitors
S	D	S	Mydriasis	Pupillary muscle	Miosis	D	S	D	I
S	D	S	Cycloplegia	Ciliary	Inappreciable	D	S	D	I
D	S	S	Asthma <sup>1</sup>	Bronchial	Relaxed	D	S	D	A
S	D	S	Tachycardia	Heart rate	Bradycardia	D	S	D	I
D	S	S	Diarrhea	Gastro-intestinal muscle	Constipation	D	D	S	A
D	S	S	Biliary colic <sup>1</sup>	Biliary muscle	Biliary colic relieved	D	D	S	A
D	S	S	Renal colic <sup>1</sup>	Ureteral muscle	Renal colic relieved	D	D	S	A
D	S	S		Bladder muscle	Strangury and acute retention (acute poisoning)	D	D	S	A
					Quieted	D	D	S	A
D	S	S	Dysmenorrhea	Uterine muscle	Diminished	D	D	S	A
D	S	S	Epiphora	Lacrimal secretion	Diminished	D	D	S	A
D	S	S	Coryza	Nasal secretion	Diminished	D	D	S	A
D	S	S	Salivation	Buccal and submaxillary	Diminished	D	D	S	A
				Secretion	Diminished	D	D	S	A
D	S	S	Bronchitis <sup>2</sup>	Bronchial secretion	Bronchitis <sup>2</sup>	D	D	S	A
				Gastro-intestinal secretion	Hyposecretion symptoms	D	D	S	A
				Pancreatic		D	D	S	A
D	S	S		Biliary		D?	D	S?	A
?	?	?		Renal secretion		D?	?	S?	A
D	S	S	Hyperidrosis	Dermal secretion	Hypodrosis	D	D	S	A <sup>3</sup>
S	D	S	Contraction pains	Vasomotors	Facial dilatation	D	D	D	I
D	S	D	Lowered further	Blood pressure	Lowered	D	D	D	I
S	D	S	Increased <sup>4</sup>	Respiration	Decreased	D	S	D	I
S	D	S	Increased?	Metabolism	Decreased	D	S	D	I
D?	S?	S	Profuse flow	Menstruation	Decreased or absent	D	S	?	?

<sup>1</sup> Not always present.<sup>2</sup> One dry, the other (withdrawal) exudative.<sup>3</sup> Pharmacologically shown.<sup>4</sup> Due to increased heart rate.

That the occurrence of some of these symptoms during the habit has been understood for some time is shown by the following observation of Albrecht Erlenmeyer (16), who first advocated sudden withdrawal of morphine in the cure of the habit.

"The withdrawal symptoms are to be encountered not only during a withdrawal cure, but also during the habit itself. Every injection acts very naturally, but for a definite period, the length of which depends upon the dose. If this action commences to cease or stops entirely, due to the failure to make another injection, withdrawal symptoms will appear."

The failure to appreciate this to its fullest extent has seriously retarded our understanding of the action of morphine as a habit-forming drug.

The explanation of this sudden reversal of symptoms lies in the fact that morphine taken as a habit-forming drug upsets the normal equilibrium between the sympathetic and the autonomic systems, establishing a new one. When this new equilibrium is destroyed by taking away the drug, symptoms naturally result.

A description of the withdrawal symptoms warrants a classification. The words *withdrawal symptoms* imply that the symptoms are due to the absence of morphine, that this absence is the *primary cause*. Since this is not the entire truth, the symptoms of withdrawal have been divided into two general classes:

Class A.—Symptoms referable to the effects of morphine.

Class B.—Symptoms referable to conditions existing before the onset of the habit. (1) Physical, (2) Psychological.

*Class A.*—These symptoms are the opposite to those produced by morphine. The muscular elements of the eye become very active. The pupil dilates. Its reactions are very labile. Accommodation paresis is common and troublesome. Diplopia occurs sometimes.

The lachrymal gland becomes very active. The conjunctival sac becomes moist and tears are often the result.

The nasal secretions are increased. Coryza is frequent. Sneezing, due in part to increased reactivity of the nervous system, in part to local irritation of secretions, is one of the first symptoms, one of no mean diagnostic value in an attempt to discover the presence of a habit by withdrawal.

Asthma is often complained of. That is, a bronchospasm. A "cold" appears in some, a mild bronchitis, due to hypersecretion of the bronchial epithelial glands, not at all like the dry hacking cough occasionally found in the habitué.

The rate of respiration increases on withdrawal.

Symptoms referable to the heart are the most dangerous. They are best considered with those referable to changes in blood-pressure. The heart-rate is increased, the pulse may become very rapid, thready, a sign of impending collapse. The blood-pressure falls, *due to cardiac collapse*.

Salivation is one of the first symptoms of withdrawal.

The hypoacidity of the habit reverses itself. Hyperacidity takes its place. This formed the basis of Hitzig's (30) method of withdrawal. By giving alkalis, Erlenmeyer modified the gastric lavage used by Hitzig. Erlenmeyer's experience with this method, lasting over twenty years, has been most gratifying. Diarrhea is prevented, and the visceral symptoms in general are almost nil.

Besides hyperacidity, nausea and vomiting are frequent, due to the labile and over-active nervous system.

The chronic constipation of the habit changes to a profuse diarrhea. Colicky pains may accompany this.

Profuse sweating is one of the first signs of withdrawal and stands as a contrast to the dry skin of the habitué. In the first paper we used this fact as a proof that morphine depresses the sweat-apparatus. Those who have seen the dry skin of the habitué and the sweating of withdrawal will realize their relation. Vasodilatation accounts for the mild perspiration produced occasionally by morphine in therapeutic or slightly larger doses.

The cramps in the extremities are among the most distressing of withdrawal symptoms. They are due to a vasoconstriction and recall the cramps produced in some individuals by very cold water. Adrenalin was tried in a few cases, and, as was to be expected, increased the suffering. The beneficial effect, on the other hand, of hot baths is well known. Nitrites are also of great benefit.

The menses are almost always absent during the entire period of chronic morphine poisoning, excepting a short time at the beginning of the habit. However, in spite of this amenorrhea, pregnancy may occur, showing that the ovary, as far as the follicular apparatus goes, is still functioning. The explanation for this is not readily obtained, for the many aspects of the relations of the ovary to menstruation are as yet unsettled. After a cure, the menses return. The first few menstrual flows are usually excessive in amount and duration.

With the exception of a primary euphoria, those addicted to morphine have little or no sexual interest (in the narrower sense of the word). After withdrawal this usually returns, and with great intensity.

There is, as a rule, an absence of spermatogenesis during morphine addiction. This disappears on withdrawal.



During chronic morphinism the power of erection is often lost. Upon withdrawal it usually returns. Nocturnal pollutions may occur.

In chronic morphinism, there are a number of symptoms suggestive of chronic hypothyroidism: dry skin, trophic changes in the nails, teeth and hair. Besides this, there are the entire group of vegetative nervous system symptoms, which may form a part of hypothyroid states (26, 27). Gottlieb (28) showed that thyroid-fed rats had a diminished tolerance to morphine, while thyroidectomized rats showed an increased tolerance. From this we could say that rats tolerated morphine in proportion to the degree of hypothyroidism. If this is proved by further work, it will be of great value in determining the best dose of morphine in dysthyroidism. Furthermore, if morphine is tolerated better by thyroidectomized rats, it would seem but natural that as a tolerance to morphine is obtained, a concomitant hypothyroidism should result. The evidence of the physical findings in chronic morphinism points to a depressor effect upon thyroid activity. The thyroid is the familiar accelerator of metabolism and the vegetative nervous system. Thus there is depression of an accelerator function.

Since there are vegetative nerves to the thyroid, it is probable that any effect produced results from changes in their activity. Morphine has no action upon gland tissue.

The symptoms which have been described are all attributable to the lack of the effect of *morphine* upon the organism—more particularly upon the vegetative nervous system. *They are clearly the opposite to those produced by morphine, and thus serve as a further proof of the effects of its action.*

*Class B.*—The symptoms which are referable to previous conditions are indeed numerous. Pains of all kinds, masked by the analgesic morphia, come to the fore. Colic, pleurodynia, dysmenorrhea, peritoneal pain (old adhesions), neuralgias and a host of others. These are not due to the morphine primarily. Some other cause exists. They are a frequent cause of continuation of a habit, an important factor to bear in mind. A case which emphasized this was that of a young man who, after withdrawal, had returned to the use of heroin. He was re-admitted to the hospital. He could not sleep well and had no appetite. Physical examination showed that he had a large amount of fluid in the left pleural cavity. On careful questioning, it turned out that he had returned to the use of heroin because of pleurodynia, which he thought due solely to the lack of the drug.

The psychical symptoms upon withdrawal are of no less import. The patient becomes excited, tremors are seen, anxiety is marked. Psychoses of various types may develop and attempts at suicide are a grave practical danger. A detailed account of the various psychopathic manifestations upon withdrawal cannot be given here. P. Schroeder (24) has given an excellent summary, and should be consulted by those desiring closer knowledge of this aspect of withdrawal.

### CONCLUSIONS

1. The withdrawal symptoms of chronic morphinism are due to a change in the activity and reactivity of the vegetative and central nervous systems.
2. They are the opposite to those of morphine administration.
3. They are divisible into two classes: (*a*) those due to the effects of morphine; (*b*) those due to the previous conditions brought to light by the absence of morphine.

### PART III: THE PULSE-RATE ON WITHDRAWAL FROM CHRONIC MORPHINISM BY THE LAMBERT METHOD<sup>4</sup> (17)

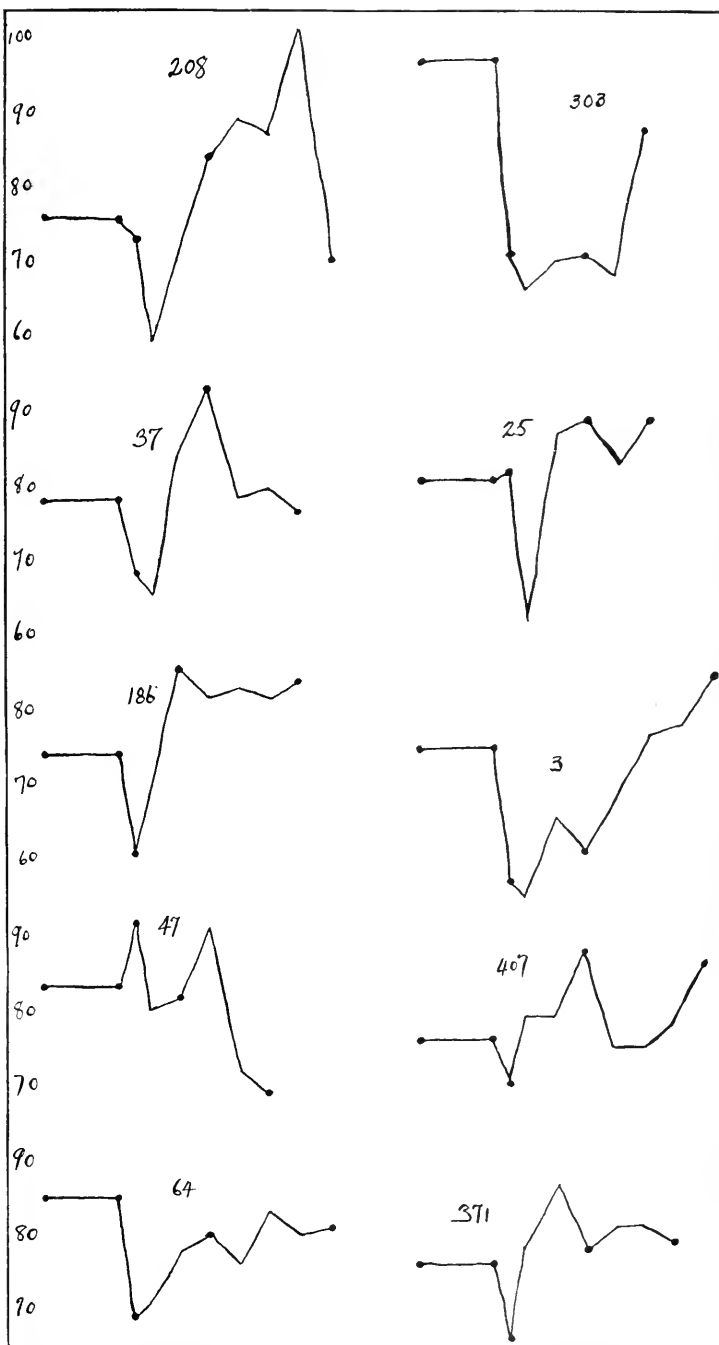
The pulse-rate during withdrawal from morphine by the Lambert method has not been the subject of any *detailed* study. In following the course of the treatment, reliance has been placed more upon the subjective condition of the patient, both mental and physical. Rise in pulse-rate has been considered to some extent; particularly as a sign of danger. The striking fact is that there has been no objective observation which could serve as an index of the progress of the treatment.<sup>5</sup>

Observations have been made upon fifty cases (Figs. 5-25). The pulse-rate was taken every four hours, before, during and after treatment. In making the graphs, averages of twelve or twenty-four hours were taken. The first two and one half days comprise the period A-B before treatment, during which the patient was kept comfortable by a suitable dose of Magendie's solution.<sup>6</sup> The next period is the twelve hours after the Lambert's specific was begun (Fig. 26). The end of the next period, C-D, represents the end of the effect of Magendie's solution given the first twenty-four hours. The period D-F is that during which the treatment was

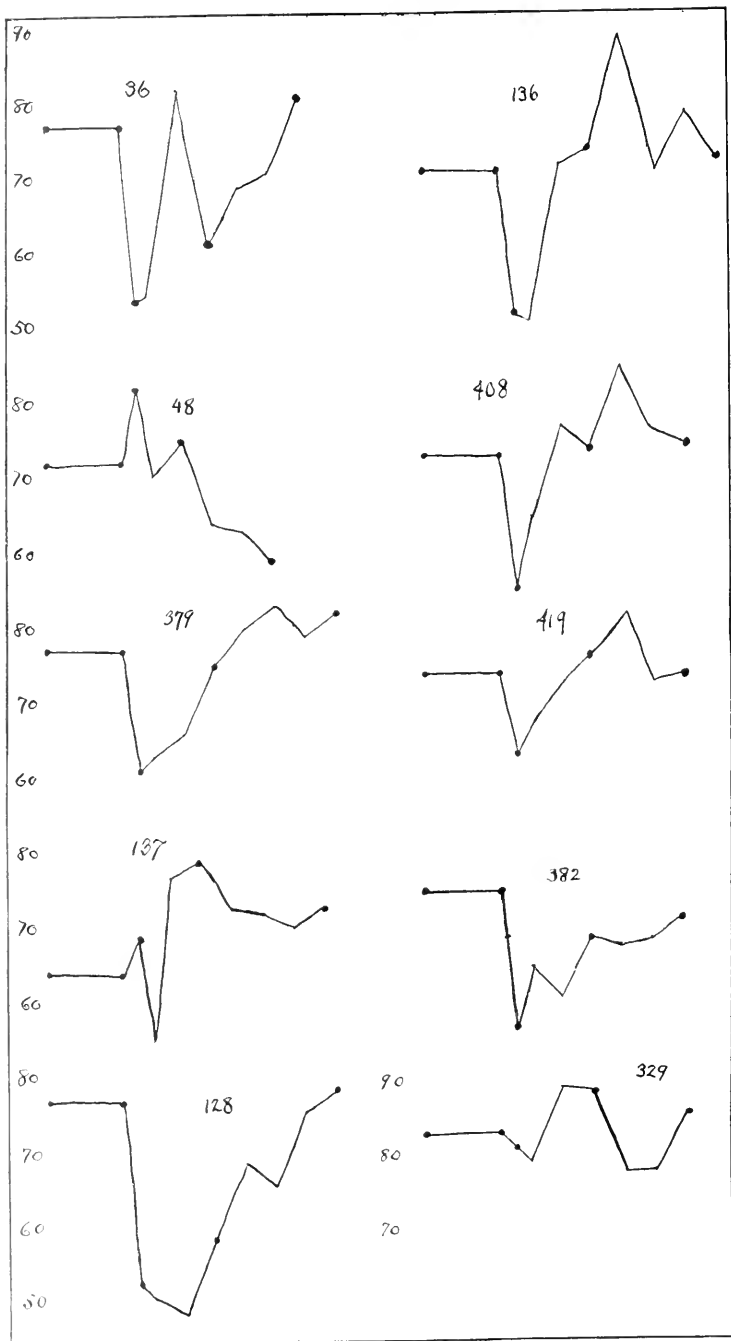
<sup>4</sup> Based upon fifty cases.

<sup>5</sup> The treatment consists essentially in giving large doses of Belladonna (see Fig. 6) and very strenuous catharsis.

<sup>6</sup> One drachm in twenty-four hours usually sufficed (morphine gr. ii).



FIGS. 5-15. Showing drop in pulse rate in morphine withdrawal and subsequent rise.



FIGS. 16-25. Showing drop in pulse rate following morphine withdrawal and subsequent rise.

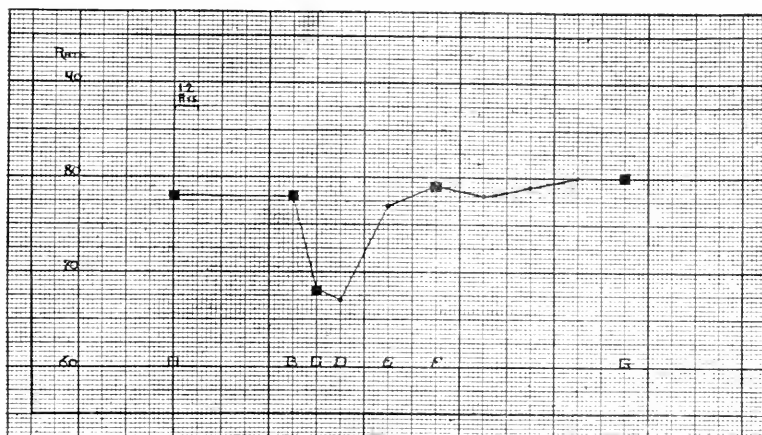


FIG. 26. Combination graphic.

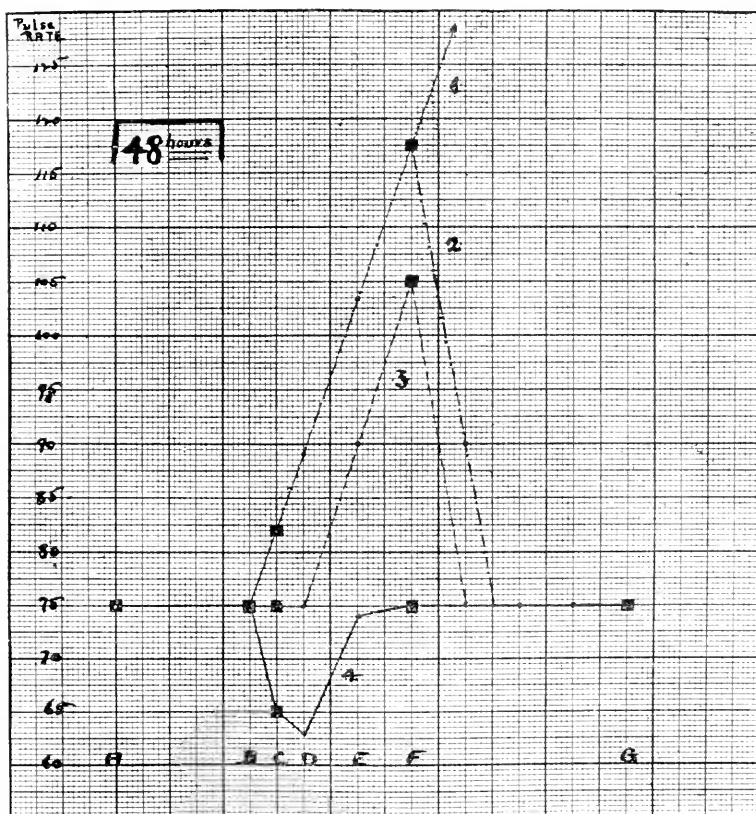


FIG. 27. Combination graphic with belladonna dosage graphic.

continued without morphine. Period F-G represents after-treatment during which no drugs were given (Fig. 27).

### Case Reports

Case Number	Age	Sex	Amount of Morphine Needed to Keep Patient Comfortable	Duration of Habit	Duration of Treatment	Drugs Used During Habit
			Grains	Years	Hours	
3	30	M.	2	12	72	Cocaine, morphine.
25	41	M.	2	13	72	Opium.
36	30	M.	2	5	72	Opium.
37	34	M.	2	7	72	Opium.
47	20	M.	2	$3\frac{3}{4}$	48	Heroin.
48	25	M.	2	$1\frac{1}{2}$	48	Cocaine, heroin.
64	34	M.	2	1	72	Morphine.
128	20	M.	2	1	72	Heroin.
136	26	M.	2	1	72	Heroin.
137	19	M.	2	1	72	Heroin, morphine.
186	25	M.	3	8	72	Heroin, morphine, opium.
208	24	M.	2	8	72	Morphine, opium.
303	19	M.	1	$1\frac{1}{4}$	72	Heroin.
329	40	M.	2	14	72	Morphine.
371	19	M.	2	$1\frac{1}{4}$	72	Heroin.
379	19	M.	2	$2\frac{1}{2}$	72	Cocaine, heroin.
382	28	M.	2	2	72	Heroin.
407	40	M.	2	14	72	Morphine, opium.
408	23	M.	1	1	72	Cocaine, heroin.
419	20	M.	1	1	72	Heroin.

Hours	Hours	Lambert Dosage Amount Given Each Six Hours	Lambert Dosage Cumulative	Usual Dosage Cumulative	Ratio n Per Cent.
Twenty-four	Six	0	0	0	66
	Six	36	36	24	
	Six	48	84		
	Six	60	144	48	
Twenty-four	Six	72	216		33
	Six	84	300	72	
	Six	96	396		
	Six	96	492	96	
Twenty-four	Six	96	588		19
	Six	96	684	120	
	Six	96	780		
	Six	96	876	144	

Drops of 10 per cent. tincture of belladonna, calculated, given at various stages of treatment. Normal dosage charted for comparison.

### CONCLUSIONS

1. The effect of the Lambert method upon the pulse-rate in withdrawal shows:

A. That the threshold of irritability of the vegetative nervous

system of the morphine habitué is abnormally high (large changes in pulse-rate).

*B.* That very large doses of belladonna are tolerated by this increased resistance of the vegetative nervous system.

*C.* That the pulse-rate drops at the beginning of treatment and slowly returns to normal.

*D.* That the pulse-rate may serve as an index of the progress of treatment.

*E.* Whether or not these pulse changes are due to the large doses of belladonna is as yet undecided.

### SUMMARY

Several observations can readily be made upon the data given above. The first is that much remains to be discovered concerning the details of the action of morphine. The site of action requires careful investigation, even though the majority of the evidence points at present to a central action. The action upon the isolated intestine and upon pain fibres brings up the question of the action of morphine on nervous tissue in general. The action upon nerves also requires careful reinvestigation. The views of Gaskell (*The Involuntary Nervous System*—1916) must be considered as well as those of the Vienna School, specially in regard to the alimentary and uro-genital structures. For the sake of securing a general conception of action, the scheme offered will suffice. It clears up and generalizes where hitherto there could be no generalization. The action upon organ activity is still insufficiently worked out in some case, notably the uterus. The effect upon function is best understood, the apparently anomalous actions of the eye, gastro-intestinal tract and bladder having been worked out in this paper.

The final word seems to be that future work must decide whether the effect upon function is brought about indirectly (Central Inhibitory Mechanism) or directly by stimulation of the inhibitors and depression of the accelerators of one or the other systems.

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I wish to express my thanks to Dr. M. S. Gregory for permission to publish these cases from his service. I wish to express my thanks to Dr. Alexander Lambert for much very valuable assistance in preparing the manuscript, and to Dr. William D. Cruikshank for valuable assistance in preparing the statistics of the pulse-rate and for general suggestions for the entire paper.

141 WEST SEVENTY-FIFTH STREET,  
NEW YORK CITY.



## Society Proceedings

### BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY

MEETING OF THURSDAY, MARCH 21, 1918

DR. CHARLES G. DEWEY, president, presiding

#### THE NEUROSIS OF THE HOUSEWIFE

Dr. A. Myerson presented a short communication on the above topic. He said that the housewife here considered is usually poor and of Jewish race, though she has her counterpart in well-to-do households and also has her Gentile sisters.

Superficially her symptoms are those of pains and discomforts scattered throughout the body, the enumeration of which includes aches and pains in every part of the body. But behind them are moods and emotions, particularly fear in its various forms, depressions, loss of interest, difficulty in making decisions and in the more severe cases, a dream-like state and feeling of unreality. The differential point between these processes and the depression of manic-depressive psychosis lies in the fact that they are largely ideational and are not accompanied by true retardation.

Back of these symptoms are the social, economic and domestic conditions of the home. All the factors,—monotony of the house work, denied recreation, poverty with its depressing effects and its lowering of respect for the husband, the breaking of sex interest, the fear of pregnancy and unsatisfied sex desires,— estrange the wife from the husband. The social standards demanding of a wife a love for home and husband bring about conflicts which in turn seem responsible for the bulk of the symptoms presented.

#### ACUTE VASOMOTOR PARALYSIS AS A CLINICAL ENTITY

Dr. Frederic J. Farnell presented a short paper on this subject, supporting his contention that there is such a clinical entity by clinical, pharmacological and pathological evidence. He presented the record of a case occurring in a married man of forty-five. He presented in 1916 the symptoms of cardio-spasm, asthma, hyperacidity and dyspnea. Physical examination was entirely negative, the urine was normal in every respect, X-ray studies of the gastro-intestinal tract and chest were

essentially normal save for suggestion of right ventricular hypertrophy, electrocardiographic studies showed a large "P" deflection. The deduction was made—autonomic irritability.

The reader then discussed briefly the three units of the autonomic system, the synapse, the end apparatus in the viscera and the central cell and spoke of the action of drugs on these units. Atropine relieved the symptoms of the patient because it lowered autonomic irritability. Later, the patient developed an infection of the upper respiratory tract, which was controlled by adrenalin. Respiratory difficulty followed and there finally supervened a complete vasomotor paralysis, from which the patient died.

Pathologically, the heart showed nothing but slight thinning of the muscle bands, no evidence of endocarditis or myocarditis. The kidneys were judged to be normal on microscopic examination. The possibility of action from split proteins and bacterial poisons had been kept in mind but were not considered as etiological factors in this case.

### CHARACTER AS AN INTEGRAL MENTALITY FUNCTION

Dr. Guy G. Fernald read the paper of the evening on the above subject, remarking that the student of healthy though maleficent mental functioning in adolescents and adults takes cognizance of certain fields of inquiry not properly included under intellect. The present communication attempts to show that such fields represent minor functions under character. He quoted from a paper which he gave in 1911 to the effect that character deviates of various types should be differentiated by appropriate tests and would be properly treated if committed for segregation. He quoted also from a paper in 1916 in which the matter of character deviation was emphasized as a phase of development and dynamics, rather than a feature that could be scored numerically.

The two essential components of mentality are intelligence and character (moral force or stamina), the innate tendencies to thought and action, respectively. A tentative arrangement of some of the principal mental functions in various normal and abnormal conditions was presented in outline form.

For the purpose of mentality study, intelligence may be conceived as the thinking, inventing and deciding function and character as the emotivating, energizing and executing function of mentality. Habit is a factor of both of these functions. Volition and inhibition, though under the direction of intelligence, owe their force to character. Sentiment and emotion are related to character rather than to intelligence; intelligence may be regarded as the judicial department of the mind, whereas character is the executive department. The intellect apprehends the ideas rousing emotional reaction and suggests control of expression, but character yields or inhibits expression.

Character force makes for efficiency of personality not less than does intelligence superiority; in fact, character is the valid determinant of

personality behavior. A mentality able to plan well but in which execution is faulty may be regarded as showing character deviation or anomaly. This attempt to delineate the functions of mind is not done dogmatically but is more a categorical reference for clarity of thinking, as are other psychological distinctions.

The reader called attention to the fact that while no attempt has been made to enforce better thinking and deciding, the enforcement of acceptable behavior has been the fundamental purpose of civil and criminal jurisprudence. When the offender is of demonstrably limited responsibility because of intelligence defect, there may be judicial clemency but when the offender is demonstrably deviate in character only, there is no clemency. The law recognizes responsibility for the performance, not the selection, of acts and recognizes something that we call character deviations as susceptible of improvement.

Evaluation of personality is not confined to an estimation of intelligence alone, but includes character as well. Character development progresses far beyond the formative period of normal intelligence development, hence the two are not coextensive. Character development and deviation are not wholly circumscribed by intelligence, though not independent thereof. Studies of feeble-mindedness in physical childhood are concerned more with intelligence than with character. Personality studies of adolescents and adults find the more potent and significant factors to be character deviations. For this reason, "mental tests" adapted to childhood mental ages are inadequate to classification of adult feeble-mindedness because of the transcendent potentiality of character factors.

Character anomalies have been recognized as matters for investigation for the psychiatrists under personality studies, though as yet not measurable. But both intelligence and character defects lend themselves to recognition, classification and treatment. The need of obtaining some means of measuring character function was emphasized. The reader called attention to the need of considering in mentality investigations these matters of character deviations much in the same manner as in intelligence deficiency and mental disease.

Dr. Fernald said that this conception of mentality made for simplicity since it permits the elimination of such ill-defined terms as psychopathic personality, constitutional inferiority, etc. He said that whereas intelligence defects are not remediable, character deviations are at least susceptible of improvement under the direction of intelligence. Consequently the recognition of certain fields of mental functioning as in the province of character broadens the outlook for advance of certain cases toward character rectitude. All considerations of feeble-mindedness in physical ages above childhood take into account character as well as intelligence.

An application of these principles can be made to that group who are sufficiently well equipped intellectually to respond to appeals to

reason, *i. e.*, to those whose character is not beyond amendment—the offenders who are neither mentally diseased nor below the mental level of morosity. These are not in the schools for the feeble-minded, some are in the orphanages, reformatories and similar institutions. Most of the members of this group have missed proper early home training for various reasons. They make our potential criminals, prostitutes and vagrants. These cases are largely salvable to economic productivity before character formation is complete and propaganda for restoration would best be directed to character reformation.

That this whole problem is exciting public interest could be seen by the fact that special schools, psychopathic laboratories and other means are being created for the study and recognition of these very types of delinquents. The need of such organizations in states and municipalities as aids to the solution of judicial, sociological and economic problems has become well defined. Dr. Fernald remarked that the field was open to psychiatrists preëminently because of their special experience and training. The reader emphasized the problem as of vital importance in the broad program of conservation of resources and the reduction of the number of dependents brought about by the war. When the public realizes that many of these dependents are improvable in behavior and salvable by character training, Dr. Fernald felt sure that the public would be entirely ready to provide for such training. The two mentally hygienic purposes to be realized are to deny parenthood to the unfit and to assist the high-grade dependents to build a more worthy character and become economically successful. The sentencing of intellectually incompetent persons to penal institutions without psychiatric examination was lamented. The need of legislative enactment to humanely diminish the number of dependents, in view of these new psychiatric considerations, was strongly urged.

Dr. Fernald closed the paper by citing at length three cases illustrating the points brought out, cases in which the psychological tests, intelligence quotient and other measurable factors were at least of normal level, in which there was no mental disease, but in which the phenomena of character deviation as an improperly developed mental function were evident and marked.

#### DISCUSSION OF DR. FERNALD'S PAPER

Dr. Walter E. Fernald commented on the value of the paper as an approach to the study of character defect in subnormal cases. He spoke of the tendency on the part of students of these matters to exaggerate the relation between mental defect and anti-social tendencies, and of the frequency with which the average defective is slandered because of the over-estimation of his liability to criminalistic and immoral behavior. He felt sure that there was a failure to recognize the value of environment and training in restraining or preventing the de-

velopment of anti-social conduct. He emphasized the fact that there are good and bad defectives, some with entirely altruistic and good tendencies, and some fundamentally bad from early childhood. On the whole, he believes that mental defect is exaggerated as a cause of criminality.

Dr. William Healy emphasized the fact that in order to really know the mentality a wide range of tests must be given, many more than are included in the ordinary age-level tests. The so-called intelligence quotient frequently does not at all suggest some special disability which has peculiarly to do with behavior, such as disability in the higher forms of judgment and foresight. He cited a case of a really defective individual who had a normal I. Q. This question of character defect is well worth a great deal of consideration. In the opinion of Dr. Healy most cases can be resolved into constituent elements, as it were, and it is very important to do this in order that there may be a thorough understanding and meeting of the issues involved. It brings us to the question of the so-called morally insane and in his experience such a case without some intellectual defect has yet to be seen. He spoke of one of the cases given by Dr. Fernald, remarking that it might be a case of impulsion, the source of which might be found in some mental conflict. Altogether, each case of so-called character defect must be intensively studied before one can rule out ordinary causative conditions. He paid tribute to Dr. Fernald's work and spoke of the whole field of investigation in behavior and character deviations as one to be worked over in intensely practical fashion; it offers at the same time most interesting and subtle material for consideration.

Dr. Anderson spoke of the value of character deviations and the considerations pertaining thereto in the daily study which work in the courts necessitated. He said that many of the cases which they saw were considered normal but show strong deviations in their character make-up, frequently shallow, superficial, indolent, careless, egotistical and individualistic, to say nothing of the psychopath group: the unstable, neurotic, emotional individuals, who are lacking in inhibitions and suffer from temperamental peculiarities. He felt that Dr. Fernald's paper was a practical and important step forward in the proper attitude toward these cases.

Dr. Myerson said that the cases seen at the Psychopathic Hospital bear out the main thesis of Dr. Fernald's paper. He said that the character deviation in some cases consisted for the large part in an inability to maintain permanent purposes and that success frequently depends entirely upon such maintenance. He felt sure that success depends more upon the maintenance of permanent purposes than it does upon intelligence. He remarked further that the stability of the community depends upon the intellectually feeble-minded who constitute the backbone of society—*i. e.*, in that they are willing to do the lowest order of work upon which the industrial organization is based.

Dr. Guy Fernald closed the discussion by reiterating the necessity of

considering more than intelligence tests alone in the adjudgment of defectives. He said that the investigation of character as a major mentality function was a new additional idea, and that a consideration of personality from the viewpoint of character brought in another angle of approach to the problems pertaining to personality anomalies, exemplified by the ne'er-do-wells and potential criminals. These cases should be reached before they develop, partly by prevention of propagation. Characterological training is a very important feature.

## Translations

### THE INTERNAL SECRETIONS AND THE NERVOUS SYSTEM<sup>1</sup>

BY M. LAIGNEL-LAVASTINE

Authorized Translation by Fielding T. Robeson, M.D.

(Continued from Vol. 47, page 470)

#### (8) OBESITY

The existence of endocrinogenic obesities is no longer a matter of dispute. Mouriquand<sup>110</sup> has described them well recently in children.

I have reported several cases myself this last year.<sup>111</sup>

The only point of interest is the demonstration of a nervous factor in the determination of these endocrinogenic obesities. In the majority of cases I do not think that this exists, but believe that such obesities arise through humoral disturbance of endocrinal origin. Nevertheless a nervous factor is present in the cases noted where a cerebral tumor gives rise to obesity through pressure on the pituitary. One might also suspect, if not prove, a nervous factor in those cases of segmentary<sup>112</sup> or paraplegic disposition of adipose tissue. I have with Viard reported a case of this type, which corresponding to a trophedema of Henry Meige, studied previously with M. Sicard,<sup>113</sup> caused me to view in their entirety "the variations of the panniculus adiposis, according to the divers physiological conditions—of infancy, puberty, pregnancy, lactation, castration, and of the menopause—and to pathological conditions—of the simple or associated endocrinal syndromes, thyroidal, pituitary, ovarian, testicular, suprarenal, and parathyroidal—pursuant to their relations with the trophedema of Henry Meige, the adiposis dolorosa of Dercum, the intermediate affections between these two syndromes, to

<sup>110</sup> Mouriquand, *Congres de Pédiatrie*, Rapp., 1913.

<sup>111</sup> Laignel-Lavastine et L. Boudon, *Obésité par sarcome juxta-hypophysaire*. *Soc. méd. des hôp.*, 13 fev., 1914; Laignel-Lavastine et Pitulesco, *Obésité familiale avec perturbations endocrines*, *id.*

<sup>112</sup> Sicard et Berkowitsch, *Adipose doul. par insuff. ovarienne*, *Gaz. des Hôp.*, 1908, p. 848; Claude et Sézary, *Adip. doul. aet. remarquable de l'opoth. Thy.*, *Gaz. des Hôp.*, 1913, No. 86, p. 69; Ivanoff, *Mal de Dercum*, *R. russe de Psychiatrie*, mars, 1913; Weber, Parks, *Lipodystrophie progressive*; R. Hirschfeld, in *Handbuch der Neuro. de Lewandowsky*, Bd. IV, pp. 455-71.

<sup>113</sup> Sicard et Loignel-Lavastine, *Un cas de trophoedème acquis*, *Soc. de Neurol.*, 15 janv., 1903. *Nouv. Iconographie de la Salp.*, janv., 1903.

certain states of hardening of the skin associated with various affections of the central nervous system, or of the sympathetic or of the ductless glands, and the part which relates in their genesis to disturbances of nutrition in general and the endocrine system and the sympathetic in particular."<sup>114</sup>

## 2. Endocrino-sympathetic Syndromes

I will only retain from among the above-mentioned syndromes exophthalmic goiter, Addison's syndrome, scleroderma and diabetes mellitus by reason of their double interest, which is both doctrinal and practical, and of the large number of studies that they have occasioned, and are still causing every day.

### (1) BASEDOW'S SYNDROME

I have nothing to say concerning the immense bibliography of exophthalmic goiter, for which I refer you to Biedl's work on the subject and the recent report of Roussy at the Congress of Luxembourg (August, 1914). I will simply state that instead of taking sides for the thyroïdal theory whose last favorable pleading was sustained with excellent arguments by Roussy and Clunet,<sup>115</sup> or for the sympathetic theory defended by Gley and Cleret,<sup>116</sup> with the aid of arguments drawn from experimental and anatomo-clinical facts, one<sup>117</sup> of which is personal to myself, I prefer to say that it is the same with Basedow's syndrome as with all the endocrino-sympathetic syndromes, that they are all the expressions of a disturbance of function, and that this function is disordered as well by a glandular lesion as by a disturbance of its nervous regulating mechanism.

From a physiological viewpoint I reiterate, therefore, the unity of the Basedovian syndrome in its divers clinical modalities.<sup>118</sup>

The cases due to thyroïdal lesions are certain. I argue no more. The cases due to nervous disorders appear no less often.

Curschmann<sup>119</sup> has seen in a woman tabetic an intermittent Base-

<sup>114</sup> Laignel-Lavastine et Viard, *Adipose segmentaire des membres inférieure*, Soc. de Neurol., 11 juill., 1912; *Nouv. Iconographie de la Salpêtrière*, 1912, No. 6.

<sup>115</sup> G. Roussy et J. Clunet, *Les lésions du Corps thyroïde dans la maladie de Basedow*, *Annales de médecine*, t. 1, No. 4, avril, 1914, pp. 395-438.

<sup>116</sup> E. Gley et Cleret, *Recherches sur la pathogénie du goitre exophthalmique*, *J. de Physiol. et de Pathol. gén.*, 1911, p. 928, et Cleret, *Thèse*, 1912.

<sup>117</sup> Laignel-Lavastine et Bloch, *Syndrôme de Basedow chez une tuberculeuse*, *Arch. gén. de méd.*, sept., 1904, pp. 2456-61.

<sup>118</sup> L'épreuve de l'hypophyse (ralentissement du pouls chez les Basedowiens, découverte par Claude et ses élèves (Soc. de méd. des hop., 19 juin, 1914) permet de limiter, dans le même esprit, le syndrome de Basedow.

<sup>119</sup> Curschmann, *Sur des symptômes basedowiens intermittents (dans les tabes et l'asthme bronchique)*, *Zeitschrift f. klinische Medizin*, 1912, LXXVI, 3-4.



dovian syndrome coincident with gastric crises. He saw in this a sympathicotonic sign, and he was not far from siding with the opinion of Morat and Abadie, who saw in the lesion of the thoracic sympathetic the starting point of the Basedovian syndrome.

The beneficial influence exercised by adrenalin on the crises is to be noted.

This fact is contrary to the theory of Gottlieb-O'Connor, according to which the thyroidal secretion sensitizes the terminal organs of the sympathetic.

It is explained on the other hand by the researches of Elliot and Durham, who established the fact that after an injection of adrenalin excitation of the splanchnic nerve caused a lowering of the blood pressure instead of the normal elevation, and this exists also in gastric crises.

Being more synthetic than analytic, looking at things physiologically and not anatomically or etiologically, I conclude that the Basedovian syndrome in its fundamental mechanism is an endocrino-sympathetic syndrome, whose divers clinical types arise from various lesions, at times endocrinal (always thyroidal, sometimes thymic, ovarian, parathyroidal, etc.), at others nervous (cervical or bulbar sympathetic) under the dominance of intoxications or infections acute or chronic, either general or local, of which the most frequent are acute articular rheumatism and tuberculosis.

## (2) ADDISON'S SYNDROME

Thus from a case of Addison's syndrome without appreciable gross lesions of the suprarenals (1899) I wrote my thesis<sup>120</sup> in an endeavor to demonstrate that there were Addisonians in whom nothing was to be seen except lesions of the sympathetic, in whom the suprarenal disturbances were secondary to nervous changes, and who showed all the intermediary signs of the melanodermic<sup>121</sup> tuberculosis. To the anatomical theory of the Addisonian discoloration I put in opposition a more comprehensive physiological theory and to the lesional contingency the functional necessity.

The recent observation of N. Pende and Varvaro<sup>122</sup> came to the support of this point of view. They have seen in a man of thirty-six years of age an Addisonian syndrome secondary to a rapid pulmonary tuberculosis. At autopsy the suprarenals were normal in their make-up. In the cortex the spongiocytes were rare, and pigment was almost completely lacking in the reticular zone.

<sup>120</sup> Laignel-Lavastine, *Recherches sur le plexus solaire*, Thèse, 1903, p. 420.

<sup>121</sup> Laignel-Lavastine, *La mélanodermie des tuberculeux*, Soc. méd. des hôp., 29 janv., 1904, et *Arch. gén. de méd.*, oct., 1904, pp. 2497-2520.

At the level of the solar plexus there were two aberrant suprarenals of normal structure. The ganglia of the solar plexus were free from tuberculous lesions, but they were of notable size, and examined histologically they appeared poor in sympathetic nerve cells and rich in new-formed connective tissue. The nervous elements still seen presented pigmentary atrophy.

To-day one differentiates the primitive Addisonian syndrome of slow and progressive evolution from the secondary Addisonian syndrome, which is seen in the already more or less advanced tuberculous cases, and which has a less clearly defined symptomatology.

Pende and Varvaro think that in the first case the anatomical substratum has its seat in the suprarenal, and in the second in the region of the solar plexus. Their reported case is a type of the secondary Addisonian syndrome.

Porak and myself have observed a case which anatomo-clinically was quite similar.

Thinking physiologically<sup>123</sup> one can conclude that the Addisonian syndrome is the expression of a certain degree of chronic suprarenal insufficiency with a disturbance of adreno-sympathetic pigmentary regulation.

In this adreno-sympathetic syndrome one can differentiate two anatomo-clinical forms: one form with predominance of the suprarenal lesions, it is the most frequent, and in general is clinically primitive, the second form with predominance of the sympathetic, periadrenal, solar or splanchnic lesions. It is less frequent, often fruste, and in general is clinically secondary to a pulmonary pthisis.

### (3) SCLERODERMA

The absence of the thyroïdal sign of Vincent in acute articular rheumatisms followed at first by Basedow's syndrome, and later on by evidences of thyroïdal atrophy with the appearance of scleroderma, which sometimes is apparently arrested by thyroïdal medication, has caused a belief in the existence of a scleroderma due to thyroïdal disturbances of rheumatic origin.

This endocrinogenic form of scleroderma is not to be questioned. It is quite possible that it is not the only one, and that other

<sup>122</sup> N. Pende et Varvaro (de Palermo), *Maladie d'Addison avec intégrité apparente des glandes surrénales et avec hypertrophie des glandes surrénales accessoires*, *La Riforma medica*, Nos. 40 et 41, 4 et 11 oct., 1913, pp. 1093 et 1124.

<sup>123</sup> La communication récente de Hirtz and Debre (Addisonien observe en 1902 considere comme guéri, retrouve en 1913, autopsie), a la Soc. med. des hop., le 26 juin, 1914, et la discussion que suivit entre L. Bernard, Netter et Sergent (3 juillet, 1914, p. 20), ne contredisent pas mes conclusions.—Voir de plus Fayolle, *Thèse*, 2 juillet, 1914.

endocrinal disturbances are capable of producing scleroderma or add their action to that of the thyroid<sup>124</sup> in its causation.

In addition, in spite of Touchard,<sup>125</sup> it seems very difficult to do away with a sympathetic factor in certain cases.

Referring to an association of Basedow's syndrome and scleroderma, G. Marinesco and Goldstein<sup>126</sup> say that it is "evident that the sclerodermic syndrome does not depend entirely on a disturbance of thyroidal function, but that this disturbance exercises a certain action on the sympathetic system, and brings about in this way the appearance of the scleroderma." There are cases, as they say, which confirm all the pathogenetic theories: the trophoneurotic, the angio-trophoneurotic, the sympathetic, the vascular, the pituitary, the thyroidal and the pluriglandular. However none of these theories can be applied to these cases as a whole.

Gauthier<sup>127</sup> distinguishes two forms of scleroderma, the ordinary, depending upon hyperthyroidism, and a special type, with a less parchment-like skin and having subcutaneous fat, depending upon hypothyroidism.

Cassirer<sup>128</sup> puts in the list of the vegetative syndromes the vasomotor and trophic neurosis, among which he classifies scleroderma.

Marinesco and Goldstein consider that the thyroidal secretion acts in the cases accompanied by Basedovian symptoms, as well as in those with other thyroidal manifestations, through the sympatheticotrope action of that secretion.

The connections and even the associations of certain sclerodermas with Basedovian and Addisonian syndromes compel me to admit that if in the first place scleroderma is an endocrinal syndrome, it is also sometimes a vegetative syndrome, and that consequently it has the right to be quoted among the group of endocrino-sympathetic syndromes.

#### (4) DIABETES MELLITUS

Diabetes arises from a disorder in the regulating mechanism of the sugar function. Glycosuria, the most frequent disorder of this function, is at first heading an endocrino-sympathetic syndrome.

<sup>124</sup> Voir à l'appui: Laignel-Lavastine, Sclérodémie mélanodermique, Soc. méd. des hôp., 31 janvier, 1908; Dupré et P. Kahn, Sclérodémie et mal. de Raynaud, Soc. méd. des hôp., 11 juin, 1909; Chantemesse et Coureux, Sclérodémie avec atrophie thyroïdienne et mélanodermie, Soc. méd. des hôp., 3 juill., 1914.

<sup>125</sup> Touchard, Thèse, 1906.

<sup>126</sup> Marinesco et Goldstein, Syndrome de Basedow et Sclérodémie, Nouv. Iconographie de la Salp., juill.-août., 1913, pp. 272-290.

<sup>127</sup> Ch. Gauthier, Fonct. du corps thyroïde, R. de Méd., 1900, p. 442.

<sup>128</sup> Cassirer, Die vasomotorisch-trophischen Neurosen, 2<sup>e</sup> ed., 1912, pp. 536-700.

Without going into the secretion of sugar by the liver, which was the first internal secretion known, or into the influence of the internal secretions of the pancreas on sugar metabolism, it suffices to mention adrenalin glycosuria as well as suprarenal diabetes to show the existence of glycosuria of endocrinal origin.

In addition McLeod, after Cavazzini, has laid stress on the glycosuria following excitation of the great splanchnic and on the fact that puncture of the bulb in the normal dog is without effect after section of the splanchnic nerves.

There is need therefore of a sympathetic factor in the production of certain glycosurias.

Finally in the decapsulated dog puncture of the fourth ventricle (Mayer), as well as stimulation of the splanchnic (Gautrelet and Thomas), does not produce glycosuria. This proves the need of a double endocrino-sympathetic factor in certain glycosurias.

One can conceive, therefore, the possibility of diabetic cases, endocrino-sympathetic syndromes, in which sometimes either the endocrinal factor or the sympathetic factor seems to predominate.

### 3. Psycho-neuroses

I indicated in 1908 the importance of endocrine disorders in the psycho-neuroses. Facts published since then in the literature and my personal practice have confirmed me in my opinion. One part of functional neurology comes under the heading of endocrino-neurology to-day.

This subject will be found worthy of great elucidation. I can not go into it here, and will say but a word regarding endocrine disorders among the "nervous," the neurasthenics, the hysterics, the psychasthenics and the epileptics.

#### (1) NERVOUSNESS

It will be interesting clinically, said I in 1908, not to stop at a simple semiologic diagnosis in the presence of a neurosis, but to inquire into the reasons for the irritable weakness of the nervous system in the general functioning of the organism, and from this point of view not to neglect the examination of the internal secretions.

The Viennese School, especially Eppinger and Hess,<sup>129</sup> in the neurosis of Oppenheim, have distinguished the two clinical types of vagotonics and sympathicotonics, the relationships of which they

<sup>129</sup> H. Eppinger et L. Hess, *Die Vagotonie, Sammlung klinischer Abhandlungen über Pathol. u. Therap. der Stoffwechsel u. Ernährungsstörungen*, f. 9-10, Berlin, 1910. Tr. Kraus and Jelliffe, *Neurological Monographs*.

have striven to connect with such and such disturbances of internal secretion. Their remarkable description of vagotonics, which is classic to-day, has been translated or recapitulated in all languages. I refer you to these works.<sup>130</sup>

Before that Léopold Lévi and H. de Rothschild<sup>131</sup> had prepared the way with their excellent study on thyroidal neuroses.

In a number of cases the clinical types of neuroses, such as the vaso-motor habitus of Savini<sup>132</sup> or the emotional constitution of Dupré,<sup>133</sup> come under the heading of thyroidal neuroses, and from a diagnostic standpoint the joining of a simple clinical type to an endocrino-nervous syndrome is a step forward, because one enters a little further into the understanding of the morbid mechanism.

Moreover a good many vagotonics, like a good many sympathicotonics, also come under the heading of dyshyperthyroidal neuroses, and these different effects arising from the same endocrine disorder—supposing that it always is the same—should not cause amazement.

They are on the same order as the facts which were noted by Asher and de Rodt<sup>134</sup> in their experiments on the thyroidal secretions. According to the individual peculiarities of the animals, it was sometimes the action on the vagus and sometimes the action on the sympathetic that predominated. In addition the effect of an injection of thyroidal extracts depended in great measure on the degree of excitability of the nerves of the animal experimented upon.

This observation seemed to me as being of extreme importance and of a general application. In pointing out more or less marked reactional phenomena in the nervous system as being hand in hand with certain secretions with which they are for the moment more or less in accord, evidence is given of the dangers of too hasty inductions relative to the action of the endocrine secretions on the separate parts of the nervous system and to their specific elective action, which are to a certain extent antagonistic.

There are not only thyroidal neuroses allied with all the modalities of stimulation or insufficiency of thyroidal secretion, but dis-

<sup>130</sup> Cheinisse, *Sem. méd.*, 20 nov., 1912, pp. 553-556; W. M. Kraus et S. E. Jelliffe, *J. OF NERV. AND MENT. DISEASE*, mars, avril, mai, 1914, p. 164.

<sup>131</sup> Léopold Lévi et H. de Rothschild, *Etude sur le corps thyroïdien*.

<sup>132</sup> E. Savini, *Le type constitutionnel sympathique ou vaso-motor*, *Progrès médical*, 15 fév., 1913, pp. 82-85.

<sup>133</sup> E. Dupré, *La constitution émotive*, Paris méd., 7 oct., 1911, p. 404.

<sup>134</sup> L. Asher et M. de Rodt, *Innervat. des gl. à sécrét. int. et act. des produits de sécrét. int. sur le syst. nerv.*, *Soc. suisse de Neurol.*, 11-12 nov., 1911.

*Rev. méd. de la Suisse romande*, XXXII, No. 2, p. 183, 20 fév., 1912.

turbances of the ovaries, testicles, suprarenals and the pituitary may be the origin of beginning neuroses.

This idea of an attempt to discover the endocrinal disturbance before the neurosis becomes sufficiently marked to be morbid allows one perhaps to restore an equilibrium to these nervous temperaments through an organotherapy, which is to a certain extent prophylactic.

They are helped in this way before, to use a vulgarism, they have had a chance to get the habit of the disease.

Finally among "the nervous" endocrine disorders may be in their turn secondary to nervous disturbances. These secondary neurogenous endocrinal symptoms must not be confounded with primitive endocrine disorders—the causes of the nervous disorders. This intricacy is common among the hypophysics of Martinet; I have under observation at the present time a nervous woman with hypophysia and hypothyroidism, whose extremely low arterial tension is improved more by small doses of thyroid than by suprarenal, and I believe that it is through a nervous influence that the thyroidal insufficiency of scarlatinal origin reacts upon the suprarenal.

After what I have said concerning endocrinogenic asthenias I will be very brief as regards neurasthenia of endocrinal origin. Since attaching the importance to it that I did in 1908, I have searched for it regularly in my practice, and have often found it. The forms connected with adrenal and genital insufficiency (diastematic and prostatic) seem to me to predominate in the male, and the forms connected with ovarian and thyroidal<sup>135</sup> insufficiency to predominate in the female. Certain neurasthenias of infectious origin, such as the tuberculous, syphilitic, and gonorrheal, result as much if not more from the endocrinal insufficiency caused by the microbes than from the toxines produced by them directly.

These endocrine disorders which cause neurasthenia must not be confounded with the secondary neurogenous endocrinal symptoms, which are often seen in neurasthenias, and which bear mostly on the vegetative nervous system.

The two disorders—endocrinogenic neurotic and neurogenic endocrinal—often coexist, and by their intricacy complicate the clinical picture. The analysis can be gotten at through the therapeutic results.

*(To be continued)*

<sup>135</sup> Allen Starr, Neuroses depend upon errors of inter. secret. of the ductless glands, *Med. Record*, 20 juin, 1912.

## Current Literature

### I. VEGETATIVE NEUROLOGY

#### 1. VEGETATIVE NERVOUS SYSTEM.

**Klinkert, D.** EOSINOPHILIA, ANAPHYLAXIS, AND THE NERVOUS SYSTEM. [Berl. kl. W., Jan. 21, 1918.]

D. Klinkert reviews the various conditions in which anaphylaxis, as well as eosinophilia, occur. He states that these conditions always become grafted on a weak point of the nervous system. Thus clinically the various forms of asthma, epilepsy, mucous colitides, angioneurotic edema, etc., may be united. Anaphylaxis in itself necessarily consists in an "acquired idiosyncrasy." A reference is made next, to analogous states which are realized in certain cumulative intoxications [quinine, salvarsan]. After getting all these facts together, the conclusion is reached that the idiosyncrasy is the result of a cumulative effect caused by decreased or absent elimination.

In seric anaphylaxis the clinical phenomena measure the time taken by the organism to destroy the antigen until it can be eliminated by the urine. Klinkert endeavors to prove that the phenomena of passive anaphylaxis and antianaphylaxis carry out this view.

**Hunt, Reid.** VASODILATOR REACTIONS. [Am. Jl. Phys., Feb., 1918.]

The experiments described by Hunt are the result of an effort to find the cause of the marked fall of blood pressure after the administration of certain drugs. These experiments have led to the conclusion that there is present in mammals a vasodilator mechanism not definitely recognized which may be more perfectly controlled than any of the mechanisms generally recognized and is capable of responding with more intense reactions. The vasodilator used in these experiments was acetylcholin. The action of acetylcholin on the skeletal muscles is slight, but it has a very strong vasodilator action on the vessels of the skin and ear. It also dilates the vessels of the penis, submaxillary gland, spleen, intestines and liver. There was no evidence of a dilator action on the lung, and the action on the kidney was very slight. The mucous membrane of the nose seemed not as sensitive to the vasodilator action of acetylcholin as many other vascular areas. Atropine diminishes or prevents vasodilatation. A pronounced fall of blood pressure was caused by 0.000,000,002,4 mg. acetylcholin per kilogram. A fall of blood

pressure was also caused by injecting acetylcholin into the trachea or applying to the surface of the lung, kidney, liver, suprarenal and various muscles; while similar doses applied to the surface of the stomach, spleen and small intestine did not affect the blood pressure.

It was found that the action of the posterior root, parasympathetic and sympathetic nerves, to which vasodilator functions have been attributed, differs from the mechanism involved in the vasodilator action of acetylcholin and related bodies, and it is also different from that involved in the depressor action of epinephrin. Although capable of more energetic response than has been formerly described, this mechanism is not involved in the action of any nerves causing a fall of blood pressure. A limited number of compounds either derived from, or closely related to cholin, pilocarpine, and colchicin were the only substances found which had the same type of vasodilator action as acetylcholin. The only compounds found having a pronounced antagonistic action to the vasodilator action of acetylcholin were atropine and closely related substances. The action of acetylcholin was slightly reduced by pilocarpine and strengthened by physostigmine.

**Ayres, O.** VAGOTONIA AND GASTRIC ULCER. [Brazil-Medica, Dec., 1917.]

The term "delirium" is used by Ayres to describe the condition of a young woman who had never shown any hysterical manifestations. Her family was without stigmata, but the patient had dysmenorrhea and for the last two years had shown symptoms indicative of gastric ulcer. Then she developed a choleriform diarrhea and later severe pains from a gastric ulcer, which pains were however localized in the abdomen. The pains were severe and cardiac collapse was imminent. She had to be kept under the influence of opium or chloral during the time they persisted [twenty-four hours]. Then came convulsive spasms of the stomach, esophagus, throat and diaphragm and even under the influence of 4 gm. of chloral and during syncope these spasms continued. These convulsions did not show chorea like characteristics. They were more massive and intense; the entire chest would heave and shake, the patient became bathed in perspiration and was sore and shaken by the violence of the contractions. Sixty grain doses of chloral only stopped them for short periods from 5-10 minutes. For a period of 48 hours these convulsive seizures continued. She was menstruating at the same time and became almost in extremis being actively stimulated by saline, and nutrient enemata. As the menstruation tapered off the convulsive seizures became less violent and finally ceased. Potassium bromide by rectum in 45 grain doses seemed to offer some relief; the exact mechanism of its effect was not established; nor was it maintained by the author that this was the drug. Only inasmuch as bromide salts seem to have a definite action in blocking excessive vagotonic activity it was argued that it had been of service. The general explana-



tion offered by the author was that a delirium of the vegetative nervous system had occurred—he termed it a “tempest.” He regarded the ulcer as a point of stimulus.

**Haldane, J. S.** *VIS MEDICATRIX, VIS DIRECTRIX, VIS SCULPTRIX NATUREÆ.* [Edinb. M. J., April, 1918. Edit. N. Y. Med. J.]

There should be no room in modern medicine for misleading animistic personifications, yet these three handmaidens of Dame Nature mentioned above may be differently viewed to determine whether their names are merely the harpstrings of a fatuous metaphysics or whether they represent some actual scientific facts on which a medical science depends. Haldane makes bold to use these terms and group them as expressive of the only aspect in which medicine presents itself as a really practical science. He states through them the recognition of the functional fact which makes physiology or any other department of medicine related to any or all others. He strikes at the very foundation of the lack of interest engendered in any one department—physiology forming the particular subject of his discussion—as it is presented in the classroom, and the lack of vital application of this or any other subject to the health of the individual and the community as a whole.

In fact, in using these terms to press his point he is delivering anatomy, pathology, physiology, every branch of practice or study, from a deadening abstraction and classification, which sever, for the student's interest at least, the vital business of medicine from his classroom toil. Hard and fast conceptions of any branch of medical activity, which separate that out into a field of its own for study or application, fairly stifle the widely pulsing radiation of interest which ought to electrify any profession and send the student into an enthusiastic search for new opportunities and new constructive interpretations through the interrelations within his science. This is particularly deplorable in medicine, where the very sources of human life and health—physical, mental, moral—meet, and where they cannot be understood or adjusted unless these artificial boundaries are broken through, are completely dissolved by a more unified conception.

If pathological anatomy, as the writer says, is a figure stalking just between the chaplain and the undertaker, if physiology states dogmatically that the effect of  $\text{CO}_2$  on the lungs is exactly so and so and then finds that the organism is able under certain conditions to bring about some different effect, we have to discover some further scope for our knowledge and observation and see really what this organism as a whole, under naturally changeable conditions, is about. The body, he reminds us, is no machine whose parts can be discussed and attended to separately, each to be left then in perfect condition for its own special function while the attention is turned to another separate part.

Something makes this human organism work differently from a machine, makes the functioning of one part dependent upon that of an-

other, makes this dependence vary from day to day. Something makes the repair of it, the healing of its disorders, a matter for thorough investigation and interinterpretation. Pathology and physiology and anatomical structure, and mental behavior too, belong together, and, unless they are taught together and one constantly called in to the aid of another, each will fall dead as to interest and none will have their place in the business of establishing and maintaining human health.

The *vis medicatrix* is then only a term to suggest this, that there is some union in the working of the human organisms, body, and mind, which is effective in no one sphere but through all of the organism to restore structure and function. It is everywhere the same movement of energy shifting itself throughout the body or even expressing itself in mental images, under the impulse of which the body works, and may thus be called a *vis directrix* regulating the activities of the healthy body. If these things be so, they suggest furthermore the sum and substance of this energy working through such channels in the ages of evolution preceding the present human form, and then further in and through the latter in the work of creation. To recall to our minds this never to be neglected process this might also for convenience be called the *vis sculptrix*. And so the author has only presented and enforced the concept of the entire human being as the object of medical study and practice, a being far more than a mere mechanical organism, or a harborage of specialties for anatomical study or therapeutic endeavor. For the doctor and for the professor there is the broadly human side which makes of any one of these specialties only a part of a plastic, constantly shifting whole, for which there must be interrelation in study and adaptive treatment in therapy.

Haldane has approached this big question with a telling illustration from the physiological field, where he proves the futility of the narrow, limited method of teaching and of considering health and disease. He emphasizes the uselessness of elaborate systematic descriptions of any process or organic structure, or of precise disease reactions to harmful agents, without taking into account the regulative action which is also going on constantly. Only through this can there be an understanding of the variability of results from environmental conditions or in disease processes, and only thus can these systems of instruction come out of their formal interest, destroying encasements and show themselves related to human material. The physiological realm is however only illustrative of the entire action of the human being, and mentally as well as physically he can be understood and treated only with an appreciation of this regulative energy movement, which the writer has been pleased to call by these "old-fashioned" names.

## 2. ENDOCRINOPATHIES.

**Brooks, Harlow.** HYPERTHYROIDISM IN THE RECRUIT. [New York Acad. Med., Feb. 7, 1918.]

Brooks said that one of the greatest medical surprises to which he had been treated since on active service has been the large number of cases of hyperthyroidism, which in civil life he thought almost entirely a disease of women, particularly those very easily influenced in their youth. He lay no claim to having made a discovery in bringing this type of case to attention, for the British have described the same condition as the effect syndrome, or as "D. A. H."—discovered action of the heart.

This group of circulatory phenomena is an inseparable part of the condition known as shell-shock, which occurs in many people who have never heard the sound of a shell, and particularly among those who earnestly hope never to do so. The most striking feature of nearly every case is a very persistent rapid action of the heart, this being the symptom which brings the patient to the regimental officer. This symptom is the same in recruits presenting themselves for examination as in those who report later, after army life may have upset their circulatory equilibrium still further. The tachycardia is very seldom accompanied by arrhythmia: the rate is usually increased by exercise, although in a few cases it may be slowed by exercise, especially when the attention is distracted. Throbbing of the superficial vessels, particularly the carotids, brachials, and even the femorals are symptoms also observed; in thin people that of the aorta is evident. The polygram would indicate the difference between this condition and aortic incompetence.

It is hard to analyze the heart sounds, though in some cases there is a soft systolic murmur at the apex, transferred at times with less intensity toward the axilla. There are symptoms which are not as important as the tachycardia. The capillary return is slow, and a capillary pulse is simulated. Patients often complain of severe pain in the region of the heart, and it is often possible to indicate areas of very great sensibility to touch or pain. Rapid flushing and paling, fainting and dizziness are also symptoms. Except in over-sensitive patients, the blood pressure is very low. The symptoms are increased by epinephrin, and there seems to be over-sensibility to thyroid. The nitrites also make the symptoms more pronounced, and there is over-sensibility to vasomotor dilators. Digitalis can not control the tachycardia. The bromids give much relief in some cases, but seem to have no effect in others. Emotional instability usually accompanies this disease, and is second in importance to the tachycardia. This symptom is shown by epileptoid attacks, outbursts of passion, tears, profanity, and sometimes convulsive muscular spasms. A stage of great exhaustion follows such emotional outbursts, in fact the state of exhaustion may be so great as to make the patient appear to be dying.

Instability of the vessels of the brain may be further indicated by the *tache cerebrale*, dermographia, urticarial rashes, and the symptom of tremor which is almost constant. A very certain indication of the strong emotional element in the disease is furnished by the types of nationalities which are affected.

Brooks says that 50 per cent. of the cases which have come under his observation are Jews, the Italians are next in order, then the Irish, and last of all, the Negroes, where there was found to be only one case, and that one doubtful, from among about 5,000 recruits. Most of the patients are above the average mentally, and it is to be regretted that the condition is very often found among the most promising non-commissioned officers.

There is a definite overgrowth of the thyroid in about two thirds of these cases, or it is at least prominent. The part that heredity plays in the syndrome has a direct bearing on the question of the part played by hyperthyroidism in this condition.

Quite a few of the cases give history of goiter inherited from the maternal side. Also in some cases there is a history of hysteria, insanity, perversions, or of genius. In the long standing cases exophthalmos is found, which proves that these cases present all the principal symptoms of exophthalmic goiter. Rest is what these patients need most, particularly mental and emotional rest.

The affect of emotional shock, fright or mental injury, on exophthalmic goiter is too well known to cause any doubt, and it explains why there are so many of these cases among young men of draft age. So far there has been a question as to whether these patients would make good soldiers. Many of the patients get well under the healthy and normal camp life. If in these cases there should be careful training, not too severe until the recruit is stronger and capable of heavier work; if there is something to relieve the worry and strain, such as games, camp shows, etc., these men, who often have the finest patriotic and spiritual strength, are certain to make good soldiers; but if they are not happy, or if their strength should be overtaxed by heavy work, the recruit may break nervously, or incompetence of the heart may finally develop.

**Lévi, L.** THYROID INSTABILITY AND NEUROTIC JOINTS. [*Presse Médicale*, April 11, 1918.]

Lévi ascribes a train of symptoms appearing in a woman of 31 to a manifest instability of the thyroid gland. There were neuropathic symptoms for years, together with migraine, recurring lumbago, abdominal ptosis, nasal asthma and varicose veins. Local congestion appeared in various organs and localities and there was an anaphylactic crisis after injection of horse serum. At times there was hyperthyroidism, the basis of which was a chronic hypothyroidism, the thyroid gland thus varying in size at different times. Thyroid treatment

brought this basic level up to normal and was followed by subsidence of the angioneurotic disturbances. This corresponds with the observed effect of thyroid treatment upon urticaria, Quincke's edema and intermittent hydrarthrosis. This case and similar experience with her sister lead the writer to emphasize the consideration of the thyroid in the case of any of these exudative diatheses.

**Houssay.** TUMORS OF PITUITARY BODY. [Revista de la Assoc. Med. Arg., Dec., 1917.]

Houssay tells of over forty cases of tumors of the pituitary body in Argentina, twenty-five of which he has personally contended with and published reports on seventeen. The patients first came to him because of disturbances in vision. It is his opinion that where there is no apparent explanation, the sella turcica should be examined with the X-ray in cases of wasting of the papilla or changing of vision. Enlargement of the head, face, hands, feet, and thorax points to a pituitary tumor. Other points are given in detail.

Illustrations produced by Segura show the methods of different surgeons for removing pituitary tumors, and also gives his own method which is somewhat different than the Hirsch septal technic. No hemorrhage or shock occurs with this, and a local anesthetic is sufficient, while it allows the location of the tumor to be reinspected at any time and radium treatment. He has used this method in fourteen cases. The operation was freed from the suspicion of being the cause of death in one case because of the intracerebral growth of the tumor, which was probably malignant. The diagnosis given in two other cases of pituitary tumor proved to be wrong; the malignant tumor had originated in another point in the brain. The immediate result in all his cases was very pleasing, and with the exception of these three cases, the patients all recovered. With the Hirsch method the reinsection of the tissue beneath the mucous membrane of the septum is done according to Killian, the incision along the front margin of the cartilaginous portion. The cartilage and bone mucous membrane is then separated and turned back on one side. Then the cartilage is cut down to the mucous membrane, and is separated from the other side of the septum. In order to admit the speculum the two sheets of mucous membrane are opened. The front wall of the sphenoidal sinus is cut, making the two into one large cavity, and the sella turcica is opened, with the chisel, from the sphenoidal sinus and breaks the wall still further away to show the pituitary body. In his last seven cases he did not first remove the turbinate bones, which is a principal point in the original Hirsch method. By opening the nasal fossas with a dilator which he has had made for the purpose, he is able to stretch the parts enough to admit the speculum. The nose should be free from any inflammation, and he gives hexamethylenamin at regular intervals before and after the operation. He is careful not to cut the floor or

the roof of the nasal fossas so that no damage is done to the architectural structure of the nose, and also gives warning that the operation must be entirely controlled by the eye, never working blindly, or some injury may be done to the cavernous sinus. All the patients were helped by the operation, the success depending on the nature and extent of the tumor.

**Boas and Scholz.** CALCIFICATION OF THE PINEAL. [Arch. of Int. Med., Jan., 1918.]

In a man 74 years old, an X-ray of the skull and later an autopsy showed a distinct calcification of the gland. Boas and Scholz think that in most cases this type of calcification is only an enlargement of the normal deposit of brain sand found in the pineal gland of adults. Since calcification occurs during the normal involution of the pineal gland, it is of comparatively little importance except in very young individuals, where it may indicate an abnormally early involution of the pineal gland, and occurring at the period when the gland is normally active, may cause symptoms showing inadequacy of the secretions of this structure.

**Notari, G. A.** SUPRARENAL INSUFFICIENCY AFTER EPIDERMIC JAUNDICE. [Rivista Critica di Clinica Medica, Aug. 18, 1917.]

The findings in detail from day to day in six new cases of this type. The pigmentation resembled that of Addison's disease and the weakness was extreme. In one case there were two periods of acute suprarenal insufficiency. In these cases the sympathetic hypotony seems to be compensated for by the hypertony of the autonomic system, as shown by the exaggerated oculocardiac reflex and the organic reactions to atropin and pilocarpin. It seems evident that next to the liver and kidneys the spirochete infection causes the suprarenals to suffer most. The spirochetes accumulate in great numbers. The blood pressure was not abnormally low in the cases described, and epinephrin depressed instead of raising it, or did not change it at all. The review confirms Monti's statement that besides the direct action of the spirochetes on the suprarenals, they also suffer indirectly from the alterations noticed at necropsy in such cases in the solar plexus.

**Moreno, A. S.** MENINGEAL FORM OF SUPRARENAL INSUFFICIENCY. [Cronica Medica Lima, Jan., 1918.]

Moreno tells of severe febrile and toxic gastro-intestinal disturbance in a delicate little girl seven years old. Meningeal symptoms were included, also unequal pupils, Kernig's sign, vomiting, headache, low blood pressure, tachycardia, white dermographism and extreme prostration. Accepting these symptoms as the pseudomeningeal form of suprarenal insufficiency, he gave the little girl a hypodermic injection of 1 mg. of suprarenal extract. The next day there was no change in the dying child, but the injection was repeated morning and

evening, and the following day there was much improvement and the little patient soon began to get well. It is probable that the suprarenals were not strong, and the poisonous action produced during the severe digestive upset had caused incompetency of these glands.

**Gruber, C. M.** EFFECT OF EPINEPHRIN ON BLOOD FLOW IN MUSCLES. [Am. Jl. Phys., Feb., 1918.]

Whether epinephrin acts centrally or peripherally in producing vasodilatation in muscles was the object of this experiment. Active dilatation of the vessels in cats' muscles when the nerves are intact was found to be produced by small doses of epinephrin (0.5 to 2 c.c. 1:100,000 solution). Where the nerves were recently cut no amount of epinephrin produced any active dilatation, but where there had been degeneration of the cut nerves for from two to ten days active vasodilatation was produced by slow intravenous injection of small doses of epinephrin (1:100,000). Vasodilatation was not produced by intravenous injection of small amounts (0.5 c.c. 1:100,000) in eleven cases when the central limb in question was intact with the central nervous system. In each case the fall in blood pressure showed that dilatation occurred somewhere in the vascular system. Active dilatation was produced in perfused limbs by large amounts of epinephrin (0.5 c.c. 1:10,000) and this was accompanied by a rapid increase in blood pressure followed by a fall. It is the tonicity of the vessel wall, Gruber believes, that makes possible the vasodilatation in muscles when the small amount of epinephrin is used, the small doses (0.5 c.c. 1:100,000) bringing about vasodilatation by the action on the peripheral vegetative nerve fibers.

## II. SENSORI-MOTOR NEUROLOGY

### 1. BRAIN AND MENINGES.

**Chiappori, R.** CEREBELLOPONTILE ANGLE TUMORS [Rev. de la Assoc. Med. Arg., Dec., 1917.]

Chiappori lays stress on several things in the determination of the location of these tumors. The exact conditions surrounding the first symptomatic disturbances must be ascertained, the order of development of the symptoms and the definite character of each one.

**Ciuffini, P.** TUMORS OF THE TEMPORAL LOBE. [Policlinico, Feb. 10, 1918.]

Ciuffini shows from the report of two operations that the temporal lobe can be divided into four zones, each with its own special symptoms. In one of the cases jacksonian epilepsy was noted, originating on the paretic side of the body. Spontaneous pressure pain was found localized mainly in the frontal lobe. Hearing and sense of smell were early affected. Word amnesia, and a tendency to sensory disturbances and aphasia were present. There were early and marked changes in char-

acter. In one case the tumor was a spindle-cell sarcoma the size of a lemon. Great improvement is noted in the case of one patient, a boy operated upon last June.

**Castex, M. R.** BRAIN TUMORS. [Rev. de la Assoc. Med. Arg., Dec., 1917.]

Castex has found that brain tumors are frequent in Argentina. He bases his diagnosis mostly on clinical examination and the history of the case. Laboratory tests he believes too unreliable. Serodiagnosis is misleading as a test for the presence of echinococcus disease and these echinococcus cysts display no characteristic symptoms. Necropsy has in a number of cases revealed that a circumscribed serous meningitis could very successfully simulate brain tumor. Castex's subjects are usually at the adolescent age or adults under forty.

**Borda, J. T.** PSYCHIC DISTURBANCE WITH BRAIN TUMORS. [Rev. de la Assoc. Med. Arg., Dec., 1917.]

Borda describes in minute detail six cases of brain tumors from the psychic standpoint to substantiate his general conclusions arrived at from a wide experience with such lesions. He believes that a constant set of symptoms will result, tendency to apathy, mental torpor, forgetfulness, confusion and mental decadence, all of which are progressive and not essentially different from psychic symptoms developing from toxic causes. There may be with these delirium or stupor. He does not believe that the site of the tumor influences the character of the symptoms, even if the tumor occurs in the frontal lobe.

**Martini, T., Berterini, J. I.** ABSCESS IN THE OCCIPITAL LOBE. [Pressa Med. Argent., Dec. 10, 1917.]

These authors report necropsy findings of a patient whose symptoms had suggested cerebellar involvement. They were intense headache for two months, preceded by a suppurative process in the ear two months previously, and also vertigo with other cerebellar symptoms. The man was not seen until delirium or unconsciousness made it impossible to determine the location of the tumor. Necropsy revealed two abscesses in the occipital lobe, evidently the infection having been blood-borne, since there was no surface communication. One was old and encysted but the other was recent and had perforated into the lateral ventricle.

**Creux.** ACUTE NONSUPPURATIVE ENCEPHALITIS. [Jour. d. Méd. d. Bordeaux, Mar., 1918.]

Creux calls attention to the fact that meningeal symptoms so-called are in reality greater in extent than the meninges are capable of inducing. There lesions must be sought in the reaction in the parts which they inclose. He describes an acute case in which a young woman had had fever and diarrhea for two weeks, when coma developed, with slight trismus and slight contracture of the arms and increase of the



tendon reflexes. In the legs the tendon reflexes were abolished and the legs were relaxed. Kernig sign was not present nor any hyperesthesia nor convulsions. The temperature remained very high. The fluid on lumbar puncture was limpid and showed considerable pressure. The woman died on the third day after coma set in. Necropsy revealed merely acute encephalitis without suppuration. The bacteriologic findings were negative as far as the examination went. The remarkable variety in symptoms met with is due to irregularity in the distribution of the lesions, which quite differs from the systematic symptomatology associated with chronic disease of the nerve centers. Even if the acute encephalitis subsides without leaving a trace, there is usually manifest some definite sclerosis at certain points or in certain fibers, which acquire definite character. Suppuration usually occurs where there is mixed affection but acute nonsuppurative encephalitis has been observed with malaria, syphilis, rabies, poliomyelitis and tuberculosis, and also with streptococcus, staphylococcus and pneumococcus infection. The symptoms are localized in case of focal lesions but with a diffuse process they are, according to the localization of the inflammation, delirium, convulsions and coma. In the fetus Little's disease is a result, while in children there is cerebral paralysis or symptoms due to sequelæ of the inflammatory process, possibly typical insular sclerosis.

## 2. CRANIAL NERVES.

**Brownfield, R. R.** DETECTION OF PRETENDED LOSS OF HEARING. [Journal A. M. A., March 2, 1918.]

Detection of pretended loss of hearing with special reference to unilateral deafness, which is said by French military physicians to be a common form of malingering and one most difficult to detect, is the subject of this paper. He describes a method of testing cases by which he claims certain advantages over the acoumeter used by the French physicians. In his device batteries and make-and-break contact are dispensed with, and the ordinary 110-volt alternating commercial lighting current is used. The variable current is produced by a potentiometer. No vibrating iron is used, and the maximum strength of current employed depends on no factor except the ratio of the electrical resistances used. The sound producer is similar to a telephone receiver, except that the core is of soft iron and is not magnetized. This eliminates the variability due to demagnetization, and doubles the pitch. The sound producer is provided with three lugs to hold it away from the ear, so that the sound will be transmitted solely by air conduction. By simply turning the indicator from 100 to zero, one can cause the sound to increase from the point at which it is just perceptible to one of normal hearing, the threshold of audition, or 100 per cent. acuity, to a degree of intensity at which failure to perceive it indicates that the subject has no practical hearing. In addition to the variable receiver, there is a supplementary one that always operates at maximum intensity,

irrespective of the loudness of the other. In the usual test for acuity of hearing, only the variable receiver is used. As the subject holds this to the ear, the pointer is gradually carried from the zero to the 100 degree point and he is directed to tell at what point the sound ceases to be heard. This is noted and the movement of the pointer continued still farther, and he is asked to note the point at which it begins again to be heard. After some repetitions, the points will be found to harmonize quite closely, except in the case of malingering. The apparatus is of course out of the patient's sight—behind him. In case of a person claiming deafness in only one ear, he is made to hold the constantly loud receiver over the alleged deaf ear and the variable receiver over the other. Starting at 100 the pointer is gradually moved toward zero and he is asked to say when he first hears the sound in his ear. If he has complete deafness in one ear the presence of the loud receiver will not disturb him, but if he is merely pretending, it would be absolutely impossible for him to identify any sound whatever in his good ear, to which the variable receiver is applied, until a point on the scale is reached that would normally indicate very defective or almost no hearing for the good ear. The test can be repeated with the loud receiver disconnected, and a totally different reading secured in the case of malingering.

**Sharpe, W.** FACIAL PARALYSIS. [Journal A. M. A., May 11, 1918.]

Sharpe says that facial paralysis produces a most noticeable deformity besides causing trouble with mastication, speech, etc., and also produces a most undesirable subjective reaction. Facial paralysis may be considered of the peripheral type when the lesion causing it exists at the facial nucleus in the pons. Lesions of the seventh cranial nerve producing a peripheral paralysis occur more frequently than those of any other single nerve, and most generally from a so-called "chill" of the facial nerve; in fact very little is known as to the real cause of this type, or Bell's palsy. The common cause, however, he says, is otitic disease, and it may follow any suppurative process of the inner ear. In this connection, he mentions the relative infrequency of its occurrence after mastoid operations in recent years, owing to improved technic and greater care and skill on the part of selected operators. Another frequent cause is fracture of the base of the skull, but in the past five years out of 500 acute brain injuries, he has seen a complete and peripheral facial paralysis in but nine patients, and in only three of these patients was it permanent. A much less frequent cause is that of tumors compressing the nerve, and still other causes of the infective and toxic kind are numerous, meningitis, syphilis, traumatism in difficult labors, and war wounds, especially from gunshot. His paper, however, is mainly a description of nerve anastomosis to remedy the condition in cases that have persisted over a year. The author says if it could be decided at once that the facial nerve was

irrevocably and completely damaged, the ideal time for operation would be as early as possible, but this is rarely the case. He points out that there are anatomically only two motor nerves that can be used for this anastomosis. These nerves are the spinal accessory and the hypoglossal. The glosso-pharyngeal is too deeply situated and is inaccessible for the facial anastomosis. "In the operation to be described, only one half of the hypoglossal nerve is anastomosed to the entire peripheral cut end of the facial nerve; in this manner, not only is the easier and more rapid nerve regeneration of an end-to-end anastomosis obtained, but the hypoglossal nerve remains in continuity and regains its complete function within a period of two months. The latter is made possible by cutting several of the intact nerve fibers of the remaining half of the hypoglossal nerve and approximating them by a single suture to the peripheral cut portion of the hypoglossal nerve. Thus it is possible to use for the end-to-end anastomosis more than one third of the hypoglossal nerve, and yet only a temporary weakness of one half of the tongue occurs, and no atrophy of its muscles results." Sharpe thinks this is a distinct advance over the methods formerly used. The technic of the operation is described in detail, and the after-care is similar to that of other wounds of the neck. The article is illustrated.

**Frazier, H.** TRIGEMINAL NEURALGIA. [Journal A. M. A., May 11, 1918.]

The author says that true trigeminal neuralgia must not be confused with a peripheral neuritis caused by some infective focus, or with the neuritis of toxic or obscure origin. If he were to write on the pathogenesis of the disease, he should describe it as of ganglionic origin, and assume a lesion of the nature of sclerosis. In this present paper, however, he gives only the outcome of his experience with 293 cases, including thirty-nine peripheral operations, ninety-nine alcoholic injections, 121 intracranial operations, and thirty-four cases that were not treated. To distinguish this kind of neuralgia we might call it a "surgical" neuralgia. Rarely beginning before the fifth decade of life, and being only exceptionally bilateral, the pain is first felt in the second or third division, and usually in the terminal distribution of the intra-orbital or the mental nerve. Often two divisions, the maxillary and the mandibular, are eventually involved, and, in a minority of cases, all three divisions. At first the attacks are of a few weeks' duration, several months apart, and each itself characterized by paroxysms and remissions of shooting and tearing pain. As time goes on, however, the attacks become more frequent and the pain more racking. It usually does not die out with age, and the surgeon is finally called in, after numberless remedies have been tried. The radical operation—the avulsion of the sensory root—assures permanent relief, but if the patient is offered his choice he usually prefers the alcoholic injection, the effect of which usually dies out within a year. These are the two methods

of relieving a patient with the disease. There are a few cases in which the trouble is limited to the supra-orbital nerve, and alcoholic injection of this branch is not very effective. The percentage of failures with alcoholic injection by the inexperienced is large, and the incidence of corneal complications, apart from injuries to the abducens and oculomotor nerve, is not small. The author gives his method of operative procedure in the radical method, which he calls necessarily brief, but is rather too long to abstract. In fact the operator almost unconsciously varies the technic from time to time, and hard and fast rules cannot be laid down. Some cases are much more difficult than others, and the operator must be prepared for every exigency. The time required varies from forty-five minutes to more than two hours. He specially warns the operator of the liability of overlooking the inner portion of the root which may be attached to the dura. Some patients are annoyed by the anesthesia and the numbness that follows the operation, though most are sincerely grateful for the relief obtained. The only serious sequel, he says, is keratitis, which is readily recognized, and if properly treated the corneal ulcer will heal. The avulsion of the sensory root, as described by him, has so many advantages over the removal of the ganglion, the Abbe operation or the Hutchinson operation, that it should be and is recognized as the operation of choice. It is easier of execution, does not risk adjacent structures, is attended with a smaller percentage of corneal complications and with a lower mortality.

## Book Reviews

**Patrick, Hugh T., and Pollock, Lewis J.** THE PRACTICAL MEDICINE SERIES. Comprising Ten Volumes on the Year's Progress in Medicine and Surgery. Volume X, Nervous and Mental Diseases. Series 1917. Chicago, The Year Book Publishers.

This book in its selection of material emphasizes the trend of present-day research and clinical attention in nervous and mental diseases. Space is given first to recent findings and opinions in regard to symptomatology in neurology. Then follows a general consideration of the latest interpretations of the neuroses, with the conflict of views between the more physical interpretation of them or the more psychological. The editors call attention to the tendency toward a broader view which will in time bridge the apparently wide difference between these views. To psychoanalysis is given special place as well as to criticism of it, the intolerant nature of which the editors also deplore as exclusive of factors which have here really illuminated the fields of therapy and diagnosis.

War neuroses and psychoses occupy a conspicuous place. A large section is devoted to recent work upon the cerebrospinal fluid and diseases of the meninges. Syphilitic diseases are dealt with in connection with the discussions upon the cerebrospinal fluid and in relation to intraspinal treatment. The reports upon work in diseases of the brain and spinal cord bear full reference to ward injuries also. The progress in psychiatry is marked by discussions of the newer attitude toward psychiatric problems as well as by definite and specific lines of advance, for example, in the broadening conceptions toward the various factors at work in dementia præcox. The brief review is throughout indicative of active progress and of the special conditions for fruitful work in these fields at the present time.

JELLIFFE.

**Silberer, Herbert.** PROBLEMS OF MYSTICISM AND ITS SYMBOLISM. Translated by Smith Ely Jelliffe, M.D., Ph.D. New York, Moffat, Yard and Company.

The translator of this scholarly work has presented it to English-reading students of the mental life of the race as one of the fossil forms which thought has taken in the history of psychical development. It represents one of the many sublimation products which energy working in the human psychical sphere has taken for expression of its striving, upward tendency. The book might indeed be considered a fossil

enlarged to mosaic in variety and beauty of form, for we are reminded that thought can never confine itself to a true dead fossil form, even in the representation of its past. One has only to compare for a moment the opening parable with which the author commences his study with any ordinary elaborated dream to realize how these past forms of thought are still active somewhere in the human psyche today, presenting at least nightly such reminders of the past which we carry with us. Therefore the power which these had when they were nearer the conscious thought of the past, and the mode of interpretation and use of them then is of inestimable aid in understanding them now for the sake of their control and use. For too often not understood and valued thus historically they attain partial or complete control of present-day thought and either sorely disturb or completely submerge consciousness, which we call reason.

The first bit then in the mosaic from the thought life of the middle ages is this ancient parabola, which is presented in its original form, condensed and compact as any dream which has in a brief picture to present concrete wish images, pursuance of the purely ego pathway of desire, hindrances and thwartings of this, rationalizations and disguises creeping even into the freedom of the dream, and withal the striving after a mastery in symbolization and resymbolization of the original desire in its conflict with a higher tendency. In the quaint language and thought of this period the end is rejuvenation, restoration of health and strength, wisdom and goodness now and everlasting in the name of "God the Father, Son and Holy Ghost."

This opening section forms the text for such an elaboration of inner striving and its outward expression, both as common to the human psyche at all times and in particular forms at the period to which the book is mainly devoted. Therefore it is suitable that it should first be compared and subjected to psychoanalytic interpretation of dream and myth in order to discover the human desires and struggles expressed in it for all times and all peoples. Comparison is here freely made with reported dream interpretations from clinical experiences and with studies in mythology in which the same symbolism and the same meanings appear.

Silberer then passes to the consideration of alchemy, not as a spurious earlier chemistry, as it is too commonly conceived, but as in its truest sense and serious import an earnestly accepted philosophy tending dimly yet toward science, but by no means absurd, rather a phase in the onward development of human thought. Combined with an actual metallurgy and utilizing a special concrete metallurgic symbolism, it manifested the same occupation with more fundamental elements, such as for example human excretions, physiological processes and the like, and the effort from interest in these and through these as symbolic means to reach to higher planes of experience and accomplishment of spiritualization or sublimation.

The Hermetic Art is the special name given to this high and serious aim of alchemy. Sun and gold represent simultaneously the highest attainment in this process of spiritualization presented mystically and symbolically. Freemasonry and Rosicrucianism were two important developments of this alchemistic work, organized outgrowths of this spiritual effort. Their history is respectively traced through the uncertainty and vagueness surrounding their origins and their original relationships. Here, as in alchemy in its earlier form, it is necessary to distinguish the true endeavor containing the real spiritual striving representative of this effort to reach from the more basic elements to their higher meaning and use, from the excesses and venalities of those who followed these arts without any conception of their philosophic or spiritual significance. Interesting is the discussion of such a philosophic development of freemasonry rather than its mere outgrowth from the practical work of masonry in these middle ages.

Of particular value for the study of psychical endeavor and striving, with the pitfalls and dangers which cause disaster, are the chapters in the synthetic part of the book upon introversion and regeneration and the goal which was striven for in all this mysticism and symbolism and in the realization of the different degrees of perfection in the striving, which is illustrated from the writings of one Jane Leade, who passes in travail of soul through these stages of spiritual progress.

The book forms a mine of literary treasure, it opens up modes of thought and expression now become obscure in the misty past making their way up through the intellectual and spiritual growth of the middle ages and often disappearing under the incrustations of baser minds and those who, missing the inner meaning, went astray without attaining the growth and sublimation toward which these tended. In it all there is, however, the philosophical or better the psychical unity which still makes the effort that of the universal human psyche. Yet there is vagueness and lack of clear-cut unity in the book. It is as if the author had at his disposal so much material that he has not brought it entirely to a specific application. This makes for some difficulty in maintaining a unity and clearness in reading. Yet the trend of the book is toward a further and deeper revelation of this same striving and development of mankind and there are passages of great value for dream interpretation, for understanding of individual conflicts and for comprehending the value of the great tendencies of human nature. These are brought out in special and striking form in the chapter on introversion and regeneration, in which it is pointed out how introversion may be regressive, carrying the individual back through a shrinking into himself to infantilism and death, or it may be the source of rebirth, extending the self, furnishing him powers which make possible a greater activity and a larger life. These differences are conspicuous in the two religious types which manifest the same opposing

results. The work is well worth careful study and in fact its practical psychical value and its literary interest cannot easily be exhausted.

L. BRINK.

**Melville, Norbert J.** STANDARD METHOD OF TESTING JUVENILE MENTALITY BY THE BINET-SIMON SCALE WITH THE ORIGINAL QUESTIONS, PICTURES, AND DRAWINGS. A UNIFORM PROCEDURE AND ANALYSIS. Philadelphia and London. J. B. Lippincott Company.

This practical manual is based upon the experimental investigations regarding the use of mental tests conducted by the author in a number of public schools in New York, Princeton and Philadelphia. He realizes the inadequacy and inefficiency of applying these tests in the haphazard fashion which results from their more or less individual use in the hands of various examiners without a standardized method of using them. The Uniform Method which is here advocated is based upon a wide range of application of the Binet test and comparison with other tests in existence. Emphasis is laid upon the necessity for more complete and standardized training for those using the tests, upon the elimination of arbitrary scores for interpretation, which should rather be considered in the light of group norms and of supplementary data. There would be opportunity thus for new lines of development in the use of supplementary scales, which also would be brought under the standard.

The book contains, beside the discussion on standardizing, directions and suggestions for the use of tests, and a reproduction of the Uniform Method advocated for the applying of the Binet-Simon scale, with inserted notes as to the modifications of the latter. It points the way to greater flexibility and yet at the same time would preserve through standardization a greater accuracy and efficiency diagnostically, both educationally and clinically. It presents its material as a manual very briefly and practically. Mention is made of the "human qualities like the emotional attitude" to be taken into account, but their importance and impossibility for such statistical measurement is by no means even suggestively noted. Failure to recognize them more completely always sets apart too thoroughly and barrenly these mental tests from the important but necessarily limited part they should play in a real psychology of mental diagnosis, whether educationally or clinically.

**Maudsley, Henry, M.D.** ORGANIC TO HUMAN. PSYCHOLOGICAL AND SOCIOLOGICAL. London, Macmillan and Co.

The author of this book in his final literary message to the world claims the privilege of old age to view the facts of life as it is, from his own aloofness earned and enriched by passage through the strivings and experiences which go to make up such facts. The chief impression



to be gained from the book is that of the place of human development in and through the organic and constituting only a constantly changing part of the whole movement of evolution. This is based upon the author's fundamental point of view and conception of human activity and of this its development, the close interaction of mind and body. This is no materialism which denies the existence of mental activity and spiritual impulse and striving. Rather it finds a substantial basis for the same in their growth in organic history and their dependence upon organic existence. Maudsley does not need a precise and separating definition of mind as an entity or even perhaps as a driving force. This is contained in his conception, not excluded by it, of matter as the storehouse of past human effort, its adaptations and improvements, and not of the human organism alone but of the countless ages of organic life lying behind even its history. It is the product and record of successively complex energy transformation and activity.

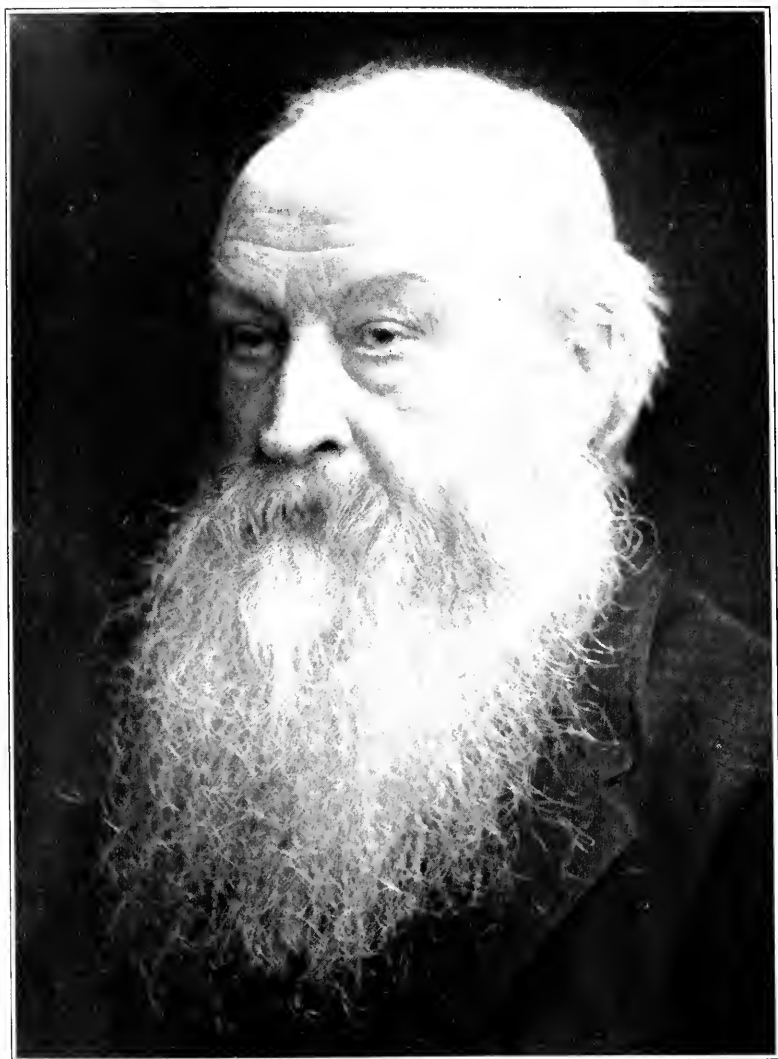
The author finds it necessary to call attention to this genetic unfolding of the human out of the organic and its inseparable relation still to organic structure, because the race has always turned its eye in upon itself in such a way as to miss what was really taking place and bound to continue to take place. It has ever been prone to be enamored of itself as it appeared at any one time or in any one structural social group and so to lose sight of the continuing process, of which this was only a passing phase. Yet ideals have grown out of this as the race has thus seized upon any phase of experience, magnified and exalted it—by his wish we might add—and projected it beyond himself. Such faiths have been mankind's incentives, only he has fallen into the danger of allowing any one of them, faith in a more universal ideal or in a more limited individual or group attainment or belief, to obscure from him the essential process of growth in which alone life lies, and because of which one such ideal or faith must in time be supplanted by another newer one. The book is therefore an effort to bring its readers to the realization of such a process in human life and a saner conception of the affairs of society because of it and more effectual handling of individual and social problems in consequence.

The discussion concerns itself therefore with the instincts upon which human society is built, briefly with the reproductive with its history from its first organic purpose, through its attempted control and regulation in advancing social life with the possible future outcome of its problems. Consciousness as it is commonly understood in its varied external manifestations, as reason, ethical ideal or what not is also presented with its immeasurable evolutionary background. Education and social transformation are viewed in the same way. The problems of social and industrial reconstruction, with particular attention to socialistic ideals and demands, are considered from all sides in a broad attempt to find in them their relation to this genetic development of the human out of and through the organic, with all that social ideals

have contained and do contain, of sincerity and true progress or of that misguided blindness in the face of ideals which has been and must be the enemy of such. In the light of the greater human history and of the natural course lying before and within the human race, earnest suggestion is made that these problems be brought to such a touchstone of true historical value. Neither a false pessimism nor a false optimism prevent just such a calm broad calculation of the possibilities of the race, whether in more immediate progress with the disasters and losses through which this is achieved, or in the very remote perfection or final passing away of this race to give place to some better product of evolutionary forces. The book allows to every man or group of men the more immediate adjustment and improvement of affairs, in a spirit of helpful stimulus and suggestion arising out of this wide and sane contemplation. At the same time it asks that social problems shall be given this consideration which belongs to a genetic continuity more cosmic than simply human.

JELLIFFE.





HENRY MAUDSLEY.

## Obituary

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HENRY MAUDSLEY, M.D.

"It is just as natural to life to die as to live," said Doctor Maudsley himself, and truly his departure has been only a fulfilment of that quiet contemplation of both, of which he has been a master spokesman. His book "Organic to Human" in which these words occur has been the final literary expression of his own place in cosmic life and his readiness to count death but an incident in a long career. And yet his several literary works and far more the fruits of an active participation in the events of his period testify that in such life as his there is no death. There is only leaving of the activity which he has initiated or forwarded to further expansion by others and in due time displacement also of that by a wider, fuller development which time shall bring.

Such a death only serves to call attention to the sign posts which mark such a useful life and the review of them, with a comprehension of the ceaseless activity and interest which surrounded them, stimulates and inspires to the effort to "carry on" the work which to the last engaged him. At the same time it grants a so much greater view of present events that calmness and renowned courage arise out of the apparent confusion and disappointing inadequacy of civilization at the present time, and it again seems worth while to be patient with human evolution. But that this patience lies in well-directed and definitely organized activity, Maudsley's greatest monument bears positive witness.

The slowness of the collective mind, even in scientific and professional circles, to move toward a new practical undertaking delayed the completion of the plan which Maudsley had long ago devised and for which he had generously provided. Yet it has now been realized when the need for it is greatest and when war conditions will abundantly provide material with which it will prove its direct therapeutical usefulness as well as its service to the science of mental disorders. It was in 1908 that he offered to the London County Council the sum of £30,000 to provide a hospital where early cases of acute mental disorder might be treated, so that so far as possible it would be rendered unnecessary to send them to the county asylums; where they could be carefully watched so that at the right therapeutic moment they might be reached and helped and so saved from mental disaster, establishing thus to a certain degree a much-needed prophylactic treatment; where in the presence of cases of this sort much might be added to the facilities for studying the pathology of mental disease and so the institution should become a center for research work, offering at the same

time educational facilities for clinical instruction in a class of disorders not ordinarily provided for in psychiatric teaching. The hospital was completed in haste to meet war needs and has become a military center for the treatment of war psychoneuroses.

This hospital with its aims is an outward expression of the conception that lay nearest his heart and to which he gave in all his published literary work and scientific work thoughtful philosophical expression. He wished to establish here a method of work which recognized and based its therapy upon the close relation of mind and body, which expressed for him their essential unity and the continuity of the human organism with the rest of the evolutionary process. In this he has been feared as a materialist, but his thought is far too wide to be included in any such narrowed conception. He grasps rather the interaction or unity of mind and body whereby one is inexplicable or incapable of comprehension except with the other, and this it was his aim to utilize as the principle upon which mental disorders can be understood and reached. This led him to lay great stress upon somatic diseases and to desire that his hospital should be in close touch with the medical work and thought of hospitals for general bodily disease.

Mental processes in their relation to health and disease were first publicly discussed by him in his Goulstonian lectures on the "Relations between Body and Mind, and between Mental and Other Diseases of the Nervous System," which were both delivered and published in 1870. "Responsibility in Mental Diseases," "Physiology of Mind," "Pathology of Mind," "Body and Will," "Natural Causes and Supernatural Seemings," "Life in Mind and Conduct," "Studies of Organic and Human Nature," "Heredity, Variation and Genius" and lastly "Organic and Human," written in his declining years, suggest by their titles the thoroughness of interest, the philosophical insight and the practical application of his extensive learning and originality of thought, which have characterized all his work. He served also for twenty years as editor of the *Journal of Mental Science*.

Henry Maudsley was born at Rome, Yorkshire, in 1835. He graduated as M.B. in 1856 from the University of London with a gold medal in surgery. The following year he won his M.D. degree. His early appointment to the post of resident physician at the Manchester Royal Lunatic Asylum turned his attention from surgery, in which he first showed great interest, to the subject which was to be his chief field of work. Later he was appointed to the West London Hospital and afterward became professor of medical jurisprudence at University College. This post he resigned after ten years to give attention to a large psychiatric practice. He was a Fellow of the Royal College of Physicians of London and an honorary member of the Medico-Psychological Society of Paris, of the Imperial Society of Physics, Vienna, and of the Medico-Legal Society of New York. He died at his residence, Heathbourne House, Bushey Heath, Herts, January 23, 1918, eighty-three years of age.

SMITH ELY JELLIFFE.

# The Journal OF Nervous and Mental Disease

An American Journal of Neurology and Psychiatry, Founded in 1874

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## Original Articles

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### A CONTRIBUTION TO THE STUDY OF THE PATHOL- OGY OF HUMAN AND EXPERIMENTAL POLIO- MYELITIS, BASED ON CASES OCCURRING DURING THE EPIDEMIC OF 1916 IN NEW YORK CITY<sup>1</sup>

BY HUBERT S. HOWE, A.M., M.D.

FROM THE DEPARTMENT OF NEUROLOGY, COLUMBIA UNIVERSITY

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The progress in our knowledge concerning the pathogenesis of acute anterior poliomyelitis, for which we are so largely indebted to Flexner (5) and his associates, has much outdistanced the advances in the pathology of the disease. Yet it cannot be that the

<sup>1</sup> The funds by means of which this work was carried on were procured from several sources by Dean Samuel W. Lambert of Columbia University. The writer wishes to make his acknowledgment to Dr. Lambert for his generous support in carrying on this investigation.

final conception of this pathological process has been attained, and for this reason, every attempt to investigate the morbid changes incident to this infection becomes of especial interest.

The work reported in this paper was undertaken to determine whether an intensive microscopic study of the nervous system of patients dying of acute anterior poliomyelitis would throw any further light on some of the pathological problems not settled by previous studies. It also aimed to study the changes produced in the nervous system of animals inoculated with poliomyelitis virus.

The work was carried on under the direction of Dr. Frederick Tilney in the department of neurology, Columbia University. The experimental inoculation of animals was supervised by Dr. Hans Zinsser, in the department of bacteriology.

The material investigated consists of sixteen (16) cases of acute anterior poliomyelitis. Nine of these were obtained from Bellevue Hospital, five from the Willard Parker Hospital and one case each from the Presbyterian and Roosevelt Hospitals. The autopsy in each case was performed within a few hours (never more than 12) after death and the tissue fixed in Zenker's solution, 95 per cent. alcohol, 10 per cent. formalin and Weigert's glia mordant. Frozen sections were also made for the fat stains, otherwise celloidin and paraffin were used for imbedding. The stains most helpful and those used most extensively were hematoxylin and eosin, iron-hematoxylin, Van Gieson-Scharlach R and Unna-Pappenheim. Besides these, some sections were stained with R. Traina Acridin-red, water-blue, Alzheimer-Mann, Alzheimer Mallory, Cresyl-echt violet, and anilin blue—Orange G.

As we desired to make a thorough study of the cells in the spinal fluid by the Alzheimer method, Dr. Rosenbloom, of the department of health, kindly furnished us with spinal fluid from 120 cases of infantile paralysis. The specimens of spinal fluid were mixed with equal parts of 95 per cent. alcohol, and then centrifuged at high speed for one hour. The cells and precipitated albumins were thus thrown down in the form of a small clot in the tip of the centrifuge tube. This clot was imbedded in paraffin, sectioned and stained in the usual way. The result, however, was not satisfactory, as the cells appeared partially disintegrated and did not stain clearly. All of the cells thus stained seemed to be similar to the lymphocytes of the blood.

The animals experimentally inoculated consisted of eleven monkeys, twenty-seven cats, eighteen rabbits, one guinea pig and two



rats. The fixation, imbedding and staining of the tissue was carried out as in the human cases.

The first description of a case of infantile paralysis was published by Jörg (10) in 1816. He drew no conclusions as to the nature of the disorder, but noted the occurrence of a febrile disease followed by paralysis of the limbs and subsequent club-foot deformity. To Heine (8) must be given the credit of being the first to give a clear conception of this disease. In his first report in 1840 he described a number of cases of spastic paralysis in children. He gave an excellent description of the acute stage of the disease, although most of his reported cases were chronic. He further noted the recovery from paralysis in some instances and also the absence of sensory disturbances. In his case reports he separated the spastic from the flaccid paralysis but did not definitely localize the lesions until he published his second monograph in 1860 (8-A), when he gave the spinal cord as the undoubted seat of the disease. Heine's work was remarkable in that his descriptions of the pathology and localization of the lesions was made largely from deductions of clinical observations, rather than from histological examination. Besides giving the spinal cord as the seat of the disease, he further localized the lesion in the gray matter and believed the degeneration due to hemorrhages and vascular changes producing alterations in nutrition.

The first thorough microscopical study was made in 1870 by Charcot and Joffroy (3). They reported the case of an adult who had been a cripple for thirty-three years. They noted especially the absence of the anterior horn cells. This had previously been observed by Cornil (4) and later by Prevost and Vulpian (15), but was considered of no special significance. Charcot and Joffroy recognized this as the fundamental change in the disease and from this observation formulated the theory that the ganglionic cell was the tropic center both of its peripheral nerve fibers and also of the muscles innervated by them. Further than this, they believed the ganglion cells were the structures primarily affected and that the interstitial changes were only secondary.

A short time after this paper was published, Joffroy and Parrot (9) reported another case. The paralysis in this instance was of only one year's duration. They found that many of the ganglionic cells were normal in areas where there was infiltration in the adventitia of the blood vessels, and in other sections the nerve cells were absent and there was no vascular alteration to be seen.

This finding caused some doubt as to whether the process was primarily parenchymatous or primarily interstitial, but these observers still held to the theory of Charcot.

The next important pathological contribution was made by Medin (11) in 1887. In the Stockholm epidemic of that year he added to the recognized spinal form the polyneurotic, bulbar and encephalitic types. In 1888, Rissler (16) published a masterly article on the pathology of this disease and was the first to give an accurate and exhaustive description of the gross and microscopical changes in the acute stage. As mentioned before, several observers had previously described the degeneration of the motor cells and subsequent atrophy of the anterior horns, but no one before Rissler had noted the inflammatory reaction in the meninges or described carefully the infiltration of the adventitial spaces of the blood vessels. He also studied minutely the varied degenerative processes in the ganglionic cells.

The first severe epidemic on record occurred in Norway and Sweden in 1905. During this epidemic, Wickman (17) called attention to the abortive type and demonstrated that what was usually known as Landry's paralysis was really a form of Heine-Medin disease. His description of the pathological anatomy was most exhaustive and leaves little to be added. Wickman was also one of the first to outline and discuss the problems of the point of entrance of the virus and the method of its conduction to the central nervous system. He believes acute anterior poliomyelitis to be a systemic disease involving lymphatic tissues of the body causing inflammatory changes in the central nervous system not alone in the cord but also in the medulla, pons, cerebrum and cerebellum. The degeneration in the ganglionic cells probably results from this interstitial inflammatory process but may possibly be due to direct action of the virus. The intensity of the inflammatory process is dependent mainly on the richness of the vascular supply.

Previous to Zappert's (18) work in 1909, the pathological studies had been limited to the changes in the nervous system and the muscles. This author noted that there was a hyperplasia of the lymphatic tissue throughout the body.

In 1912, Peabody, Draper and Dochez (14) presented a more thorough study of the visceral changes. They noted the general lymphatic hyperplasia, cloudy swelling of the parenchymal cells of all the principal organs, focal necroses in the liver and enlargement of the splenic follicles.

## PATHOLOGICAL ANATOMY

In the present study attention was directed to the special changes occurring in the tissues derived from the two embryonic germ

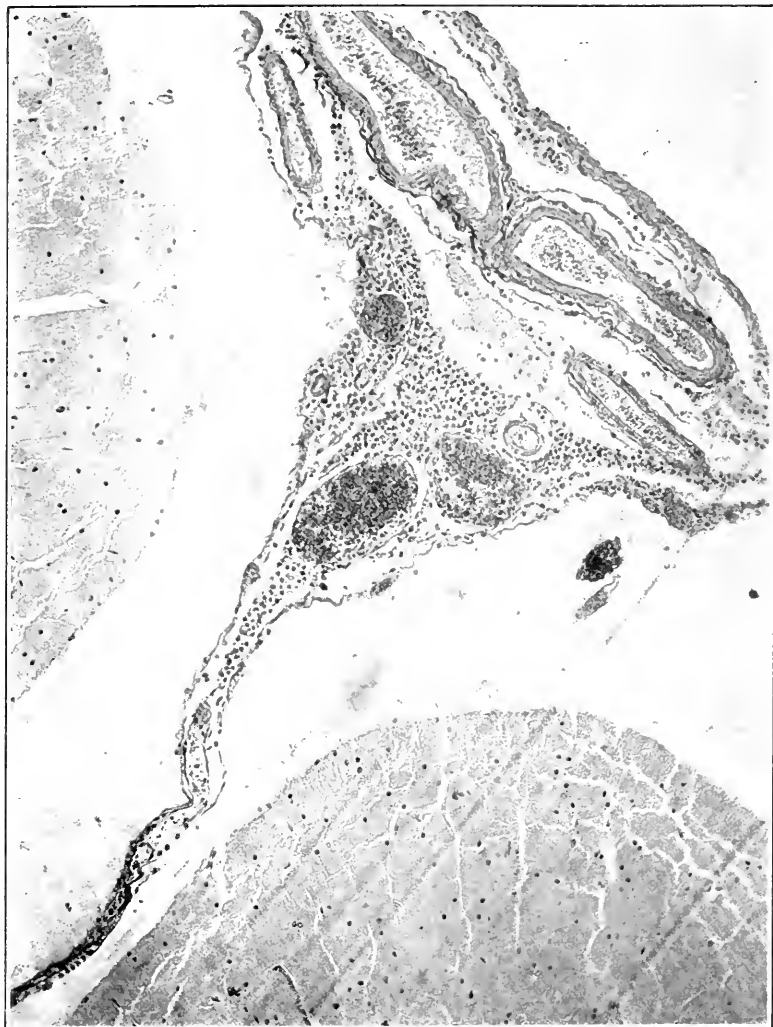


FIG. 1. Infiltration of cerebellar pia showing that the reaction is confined to the mesodermogenic elements in this instance. Human case No. 510,  $\times 150$ .

layers entering into the nervous system, that is to say, the mesodermogenic and ectodermogenic elements.

*Changes in the Mesodermogenic Tissues.*—Alterations occurring in the mesodermogenic tissues involve not only the immediate constituents of the neuraxis but to a large extent its membranous cov-

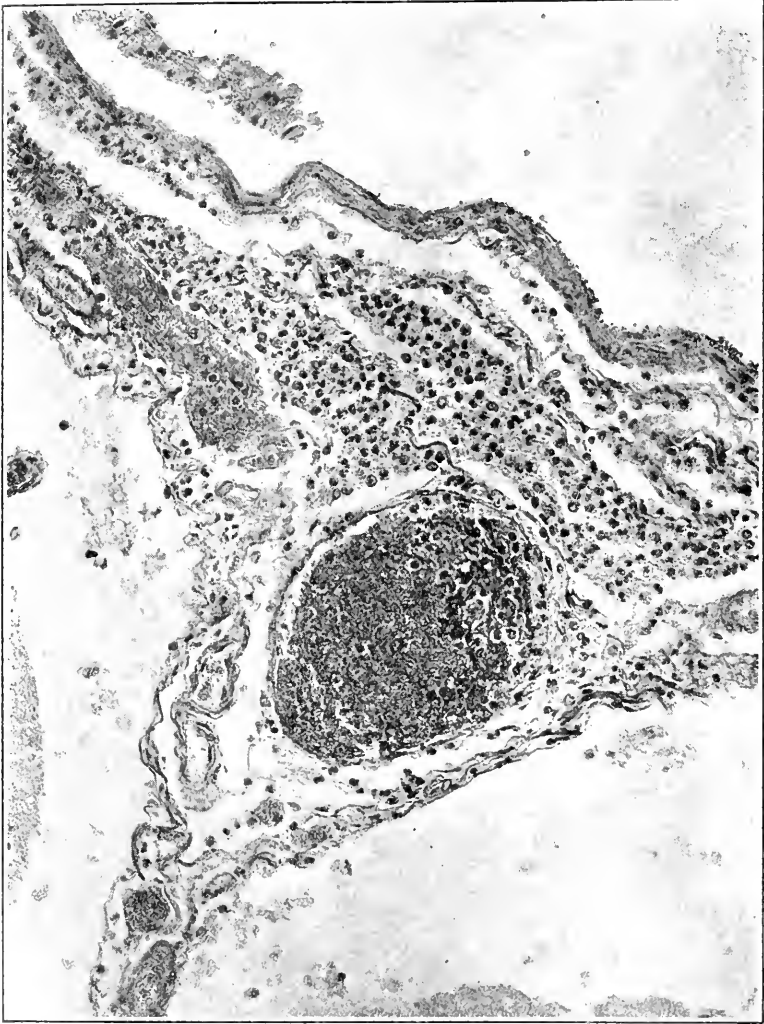


FIG. 2. Cerebellar pia, from human case No. 510,  $\times 300$ , showing the types of invading cells.

erings also. The involvement of the pia, though it is widespread over both brain and cord, is by no means uniform. We have never observed severe inflammatory changes in the telencephalic pia.

Such changes are found more often over the base of the brain. The cerebellum very frequently shows signs of pial inflammation and here the process is quite diffuse. In the pia of the spinal cord



FIG. 3. Pia covering cerebral hemisphere from human case No. 510.  $\times 150$ , showing edema with slight pial infiltration.

the affected portions are rather irregular. The inflammatory reaction is usually most marked over the anterior surface of the cord and in the fold of the anterior spinal fissure. It is generally more

severe in the cervical and lumbar enlargements. In the involved areas the pia is thickened and edematous. Its blood vessels and

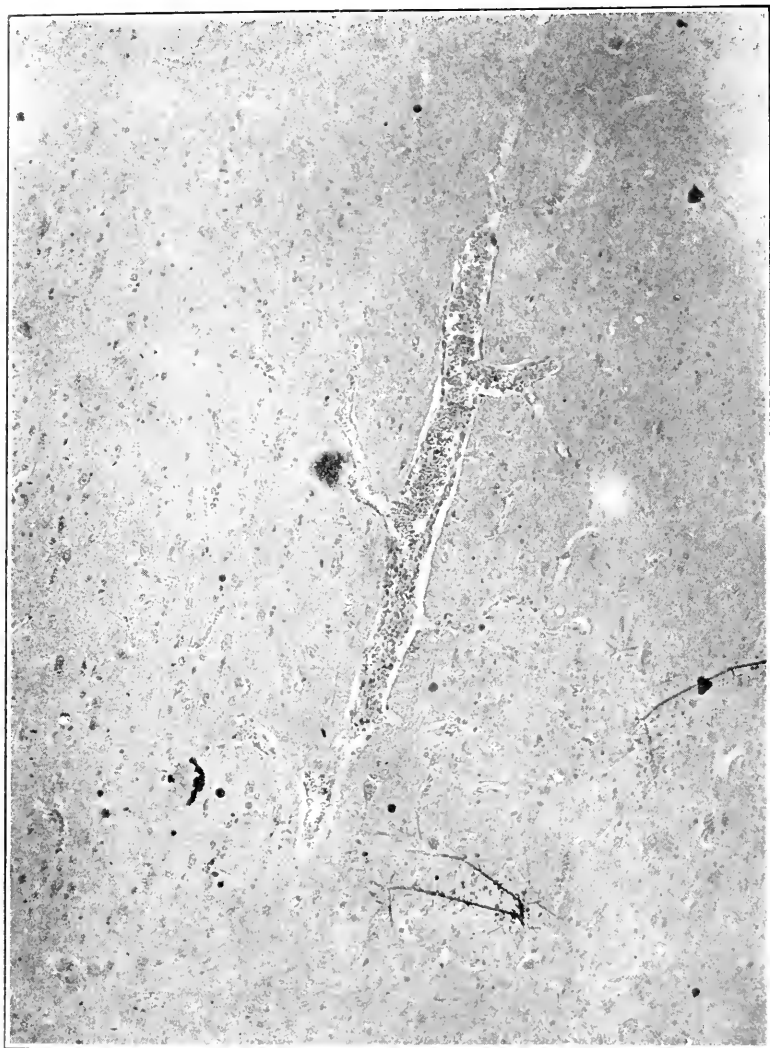


FIG. 4. Blood vessel in substance of cerebral cortex.  
Monkey 1045,  $\times 150$ .

lymph spaces are dilated and hemorrhages are usually seen. There is often a slight amount of fibrinous exudate on the surface of the pia and to some extent between the pial lymphatics. The cells in-

volved in the process are mostly small and large lymphocytes, but polymorphonuclear leucocytes, polyblasts, and plasma cells are also present.

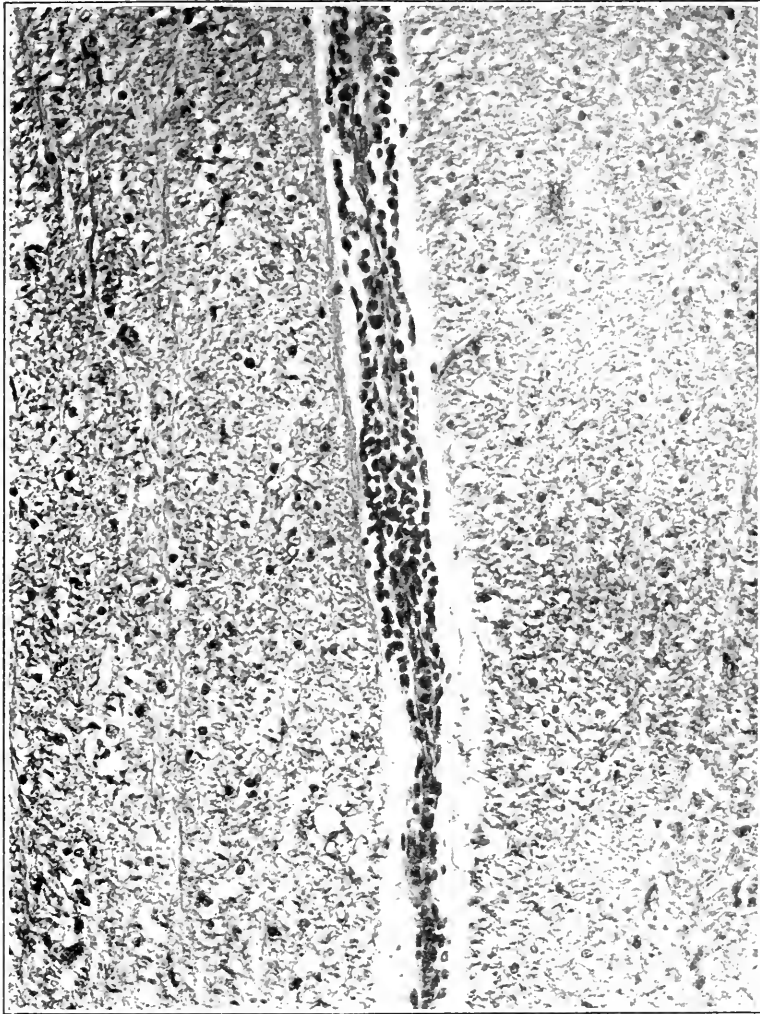


FIG. 5. Longitudinal section of a blood vessel in the spinal cord. Human case No. 507,  $\times 300$ , showing infiltration of Virchow-Robin space.

In the human cases the pia over the cerebral hemispheres is frequently somewhat edematous but only exceptionally shows much inflammatory reaction. The cerebellar pia on the other hand is fre-

quently much infiltrated. In monkeys, where the inoculation has been by intracerebral injection, the telencephalic pia is more commonly and more severely affected than we have observed in human

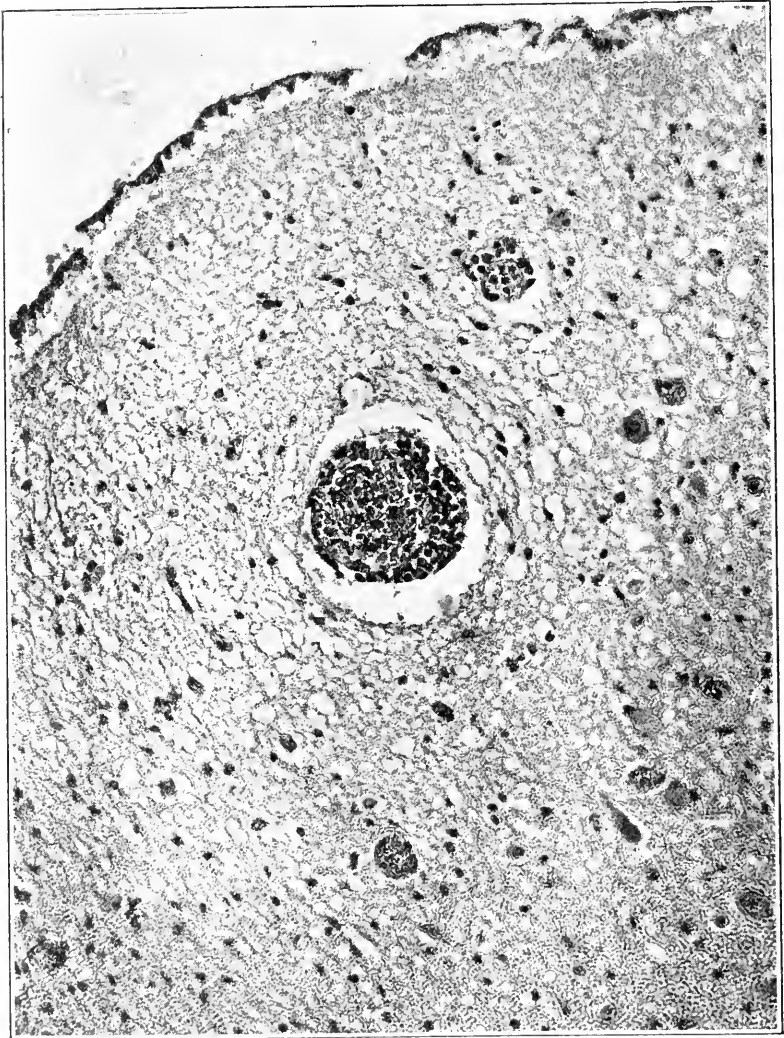


FIG. 6. Cross section of a blood vessel in the medulla oblongata. Human case No. 504,  $\times 300$ . The Virchow-Robin space is distended with cells.

beings. The blood vessels in the substance of the brain and cord are congested and in the affected areas the capillaries are dilated and tortuous. Batten (2), Mott (13), and Money (12) have described



cases in which thrombosis occurred, but we have not observed it and believe it plays no part in the pathology of the disease. Small

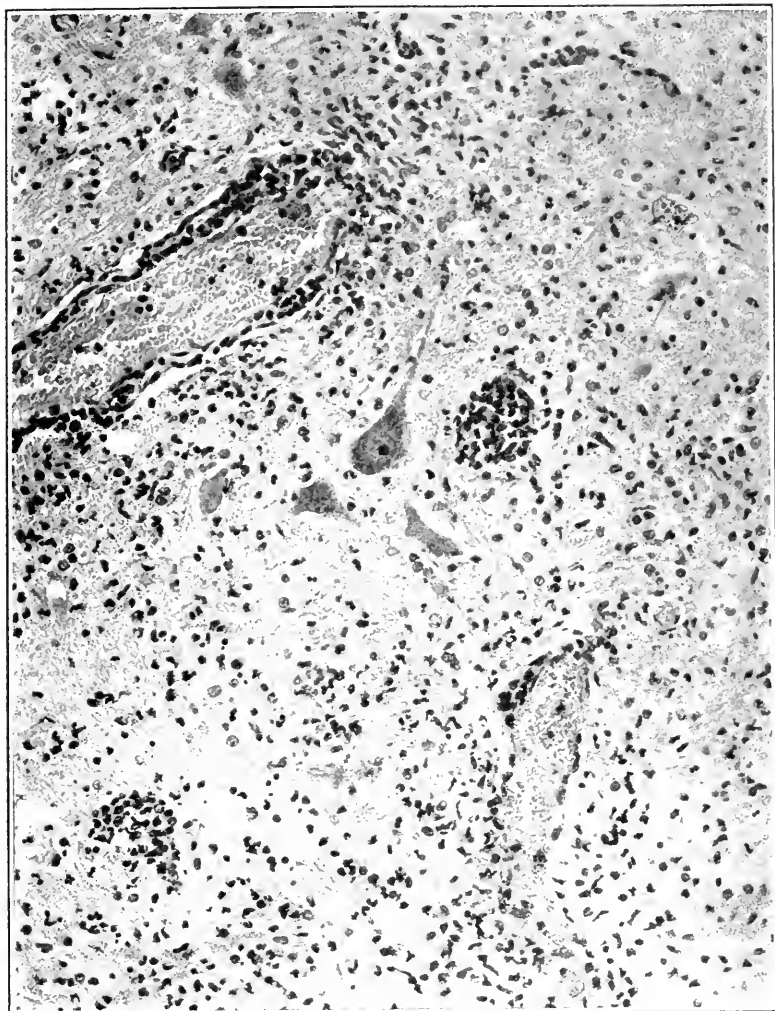


FIG. 7. Section of anterior horn. Human case No. 504.  $\times 300$ , showing a group of ganglionic cells with acute cloudy swelling.

hemorrhages are often seen both in the infiltrated and otherwise comparatively normal areas in the gray substance of the cord.

The most striking vascular change in a cellular infiltration of the adventitial lymph space or so-called Virchow-Robin space of

the vessel wall. This consists of one to several layers of closely packed cells distending the Virchow-Robin space, but not encroaching on the lumen of the vessel. It is most evident in the branches of the anterior spinal vessels and is present in both arteries and veins.

The cells participating in this process are the same as those found in the meninges, namely, large and small lymphocytes predominating, but polyblasts and polymorphonuclear leucocytes as well as a few plasma cells being present. In the cerebral hemispheres, as a rule, the vascular changes are not marked and aside from the congestion little is to be seen. At times in the human cases there is moderate Virchow-Robin space infiltration but this is never as marked as it is in monkeys that have been inoculated intracerebrally.

In the substance of the cerebellum we have never observed any perivascular infiltration, though there is usually capillary dilatation and congestion.

The interstitial tissue of the cord is usually edematous in the involved areas. Signs of edema and the absence of ganglionic cells may be about the only changes present. In the glia matrix of the gray matter there is often a marked cellular infiltration which may present a more or less even distribution of the invading cells throughout the gray substance, or it may appear as dense focal accumulations adjacent to unaffected nerve cells. In the focal accumulation, careful examination may reveal a direct relation of the invading cells to a ganglion cell or to a blood vessel, but in some areas no such relation can be found. These interstitial changes are found chiefly in the anterior horns, but are not limited to them. Similar infiltration is frequently seen in the posterior horn, but it is usually less pronounced.

In rare instances very slight cellular infiltration is seen in the white matter. When it is observed, it is in close relation to the pia or to the blood vessels.

The cerebral cortex at times shows small areas of cellular accumulation. In our series these were never large and did not show any particular relation to the blood vessels. The character of the invading cells is the same as in the cord.

We have not observed much evidence of inflammation in the substance of the cerebellum. In a few cases there have been changes in the molecular layer. These consist of a localized infiltration of cells, frequently with hemorrhage and edema. The cells are usually almost entirely ameboid neuroglia and polyblasts. Oc-

casionally, lymphocytes and leucocytes are present but they seem to be rare. The Purkinje cells in the neighborhood of these changes show acute cloudy swelling or more severe degenerative alterations. The granular layer and white matter show no pathological reactions.

It is impossible to classify all of the infiltrating cells as such a variety of forms appears, although the majority of them seem to fall into five definite groups. These are as follows:

1. Cells with a single, deeply stained, round or nearly round nucleus surrounded by a small amount of cytoplasm. These are similar to the lymphocytes of the blood.
2. Fairly large cells with faintly basophilic cytoplasm and a rather densely stained, coarse chromatin network in the nucleus. The nuclei are irregular and indented and some are sausage- or crescent-shaped. These cells are similar to the polyblasts of Maximow.
3. Cells with large, rounded, oval or irregular nuclei with a fine chromatin network and a few granules. The cytoplasm of these cells is irregular and frequently indistinct. Others of the same variety are smaller and have a coarser, deeper staining nuclear reticulum. These are apparently ameboid neuroglia cells.
4. Cells with rather large, rounded nuclei, with a clock-faced distribution of chromatin granules. These cells are similar to the Unna-Marshalko plasma cells.
5. Cells with deeply stained irregularly shaped lobulated nucleus which may be mistaken for multiple nuclei. The cytoplasm is well outlined, being densely packed with neutrophilic granules. Cells of this type are easily recognized as polymorphonuclear leucocytes.

The relative proportion of these different types of cells varies a good deal, not alone in different cases, but also in different areas in any one section. Usually in the human cases the majority of the cells consist of lymphocytes and polyblasts. In monkeys there is frequently a relatively larger number of leucocytes.

*Changes Occurring in the Ectodermogenic Tissues.*—The pathological alterations in the nerve cells vary greatly and the degenerative process may take place with or without the participation of phagocytic cells. The earliest changes are probably those of acute cloudy swelling. There is solution of the tigroid substance. The cells are swollen and more irregular in outline and with eccentrically placed nuclei. Frequently, more severe degenerative phenomena, as vacuole formation, rupture of the cell membrane, breaking up

and dissolution of the cell body, are seen, the nuclei being swollen, palely staining, irregular and degenerated. At times the destruction seems to be accomplished by a rapid disappearance of the entire cell body and nucleus, leaving no traces of degenerative products or even evidence of the cells' former situation. The entire area of an anterior horn may in this way be deprived of its normal ganglion cell content.

The point of greatest interest attaching to the alterations in the most severely affected of all the nerve elements involved in this disease is the fact that the anterior horn cells do not succumb as a result of any single process of cellular disintegration, but manifest a considerable variety of degenerative changes. It may be that these several degenerative appearances are but phases in a common disintegrative process. This view has much to commend it. On the other hand, certain observations seem to point to another conclusion and raise the possibility that the ganglionic cells may be affected by several different pathogenic influences. The cells may thus be overcome by these influences or by several of them acting simultaneously. In this light the several varieties of cellular changes observed in the anterior horn cells may represent the effects of different pathological moments. The following classification of the degenerative alterations in the ganglionic cells illustrates a number of the cellular changes observed in this study:

1. Cloudy swelling of the ganglionic cells without neuronophagy. (See Fig. 7.)
2. Acute chromatolysis without neuronophagy. (See Fig. 10.)
3. Single and multiple vacuolization without neuronophagy or chromatolysis. (See Figs. 12 and 13.)
4. Acute cloudy swelling with moderate neuronophagy without chromatolysis. (See Fig. 21.)
5. Acute chromatolysis with moderate neuronophagy. (See Fig. 22.)
6. Intense and predominant neuronophagy with disappearance of the cells. (See Fig. 11.)
7. Fat pigmentary degeneration with neuronophagy or chromatolysis. (See Fig. 16.)
8. Cellular dissolution causing complete disappearance of anterior horn cells without neuronophagy. (See Figs. 15 and 17.)

Several of these degenerative processes may coexist in the same segment of the cord or even in the same cross section, but in the main, the ganglionic cells in each case present but one type of pathological alteration.

*The Interreaction between the Mesodermogenic and Ectodermogenic Tissues.*—Another phase of the inflammatory reaction which has been investigated in this study is the relation between the mesodermogenic and ectodermogenic changes. In previous studies this topic has received much attention and unquestionably deserves a conspicuous place in the consideration of the pathology of this disease. There seems to be but little histological evidence indicative of any definite correlation in the inflammatory reactions manifested by these two types of tissue. While it may not be strictly in keeping with the facts in so far as human poliomyelitis is concerned to state that there is a purely ectodermogenic type in which no connective tissue changes occur, it is beyond dispute that in experimental poliomyelitis many instances show that the inflammatory reaction is wholly limited to the cells of ectodermic origin. Not a few cases of human poliomyelitis show such a preponderance of the reaction in the ganglionic cells as to make the connective tissue changes appear almost negligible.

A purely mesodermogenic type of cellular reaction in poliomyelitis is perhaps more difficult to make out from the observations of this study. On the other hand, the involvement of the elements derived from the mesoderm in certain cases was so predominant that the inflammatory reaction may be regarded as almost entirely restricted to the elements of mesodermic origin. This becomes all the more likely in the light of the reaction observed in certain parts of the nervous system, as for example the cerebellum, where the reaction in most cases is exclusively of mesodermogenic type.

By far the great majority of human cases of poliomyelitis give histological evidence of a mixed involvement in which the reaction has affected the tissues of both types. From these observations it is apparent that several types of inflammatory reaction may result from the infection, namely,

1. The predominately ectodermogenic type in which the reaction is confined almost exclusively to changes in the ganglionic cells and further characterized by the inconspicuous alterations in the cells derived from the mesoderm. (See Figs. 15 and 17.)
2. The predominately mesodermogenic type in which the reaction is confined almost exclusively to changes in the tissues derived from the mesoderm and further characterized by almost negligible changes in the ectodermogenic tissues. (See Figs. 14 and 18.)
3. The mixed type in which the reaction is manifested by changes in both the mesodermogenic and ectodermogenic tissues. (See Figs. 7 and 11.)

PATHOLOGICAL FINDINGS IN SIXTEEN HUMAN CASES OF ACUTE  
ANTERIOR POLIOMYELITIS

CASE I. Serial No. 501. Source, Willard Parker Hospital. Material: From spinal cord, medulla, pons, cerebellum and cerebral hemispheres.

*Spinal Cord*

*Pia Mater.*—The pia is adherent only in places. Irregularly thickened and edematous. Very moderate infiltration with lymphocytes, but many red blood cells lying free in the lymph spaces. There is very little fibrinous exudate.

*Anterior Horn.*—Blood vessels throughout are dilated and filled with red blood cells. This is especially marked in the gray of the anterior horn. The walls of the vessels appear normal except for the rupture of some of the capillaries of the anterior gray matter. Considerable fresh hemorrhage is present around these capillaries. Not only in the anterior gray but in the reticular substance of the lateral horns, there are large numbers of red blood cells lying free in the tissues. The lymph spaces are everywhere dilated and packed with cells. In the distribution of the anterior spinal and also lateral and posterior spinal arteries this is to be seen. In the anterior horns many of the infiltrated cells have escaped from the lymph spaces and lie in large groups free in the tissues clustered around the larger branches of the anterior spinal artery. The infiltrating cells in the white matter lie packed in one or two rows in the Virchow-Robin spaces. These cells have small rounded nuclei without visible chromatin network. The nucleus stains very deeply, while the cell body is poorly stained and is almost invisible. These cells give every indication of being small lymphocytes. In the ventral gray where the infiltration is most marked, most of the cells in the lymph spaces resemble those described above, but there appear as well a considerable number of larger cells similar to large mononuclears. The nuclei of these are rounded, oval or crescentic, irregular in their staining so as to give somewhat the impression of a chromatin network. Most of these cells seem to contain a larger amount of cytoplasm which appears as a clear, faintly staining ring around the nucleus. Some of these cells are undoubtedly large mononuclear lymphocytes, while others, fewer in number, resemble the polyblasts of Maximow. In places where the lymph cells lie outside the lymph spaces in tissue about the blood vessels the same cells are seen, the lymphocytes predominating about four to one over the larger cells. Here and there in these groups of clearly lymphocytic elements, plasma cells are seen, with rather small but distinctive nuclei and fairly large indefinite cell bodies.

*Ganglionic Cells.*—Of the true nervous elements the central gray in the lumbar region is distinctly edematous. All the nerve cells of the anterior horn have disappeared, likewise those of the lateral horn. The neuroglia of the central gray has undergone an intensive proliferation on the part of the cells. Most of the nuclei of these cells present a normal appearance in regard to the chromatin

501	Blood Vessels	Perivasc. Infiltration	Diffuse Infiltration	Hemorrhage	Edema	Neuronal Cloudy Swelling	Neuro- nal Dis- integra- tion	Neuronal Disappearance	Cavita- tion	Neu- rono- phagy	Types of Neuro- nophag- ocytes	Proli- feration of Neu- roglia
Cord: Pia.....	Congested	None	Moderate	Moderate	Marked	.....	.....	Complete	Slight	None	.....	Slight
Anterior horn.....	Congested	Marked	Marked	Marked	Marked	.....	.....	None	Slight	None	.....	None
Posterior horn.....	Congested	Marked	Moderate	Slight	Slight	.....	.....	None	None	None	.....	None
White matter.....	Congested	Slight	None	None	None	.....	.....	None	None	None	.....	None
Dorsal root ganglia.....	Congested	Slight	None	None	None	.....	.....	None	None	None	.....	None
BRAIN STEM.....	Congested	Slight	None	None	None	.....	.....	None	None	None	.....	None
CEREBELLAR PIA.....	Congested	None	Moderate	Moderate	Marked	.....	.....	None	None	None	.....	None
CEREBELLUM.....	Congested	None	None	None	None	.....	.....	None	None	None	.....	None
CEREBRAL PIA.....	Congested	None	None	Slight	Marked	.....	.....	None	None	None	.....	None
PALLIUM.....	Congested	None	None	None	Moderate	.....	.....	None	None	None	.....	None

network. Although in most of the cells the nucleus is normally round or oval, one sees a considerable number of cells with irregular, triangular, or quadrilateral nuclei and a few elongated or crescentic. There are in every field large numbers of cells with small pycnotic nuclei and very small cell bodies. It is very difficult to say whether these cells are young neuroglia cells or lymphocytes which have wandered away from the lymph spaces. Of the neuroglia cells observed a number are ameboid in character, as manifested by the large irregular cell bodies and equally irregular nuclei; some of these latter cells are to be seen on the borders of the degenerating cells of the lateral horns, and in some instances in the cell bodies themselves. This phagocytosis (neurophagy) is not marked, however, for the degeneration of the nerve cells appears to have taken place for the most part without the aid of the neuroglia. The phagocytes here appear to be of neuroglial origin.

*Posterior Horn.*—There is marked vascular congestion and perivascular infiltration. There are no hemorrhages, but considerable edema. There is a diffuse cellular infiltration as described in the anterior horn but of less intensity. Some of the ganglionic cells have disappeared and the majority of those which remain show an extreme grade of acute cloudy swelling; the rounded or oval cell bodies staining diffusely but with no evidence of tigroid substance. The nuclei are for the most part eccentrically placed and of irregular outline, containing a number of small vacuoles. The nucleus for the most part remains intact. Dissolution of the cell membrane is often seen, and free lying granules of degenerated cytoplasm lie outside of the cell body. None of the cells of the column of Clarke remain. There is no evidence of neuronophagy.

*White Matter.*—The fibers of the white matter appear normal. The glia reticulum is possibly increased to some extent and in spots considerable edema appears. This is more especially the case on the surface of the cord. There has been but little proliferation of the neuroglial cells, in most of which the nucleus is small and without chromatin network.

### *Brain Stem*

*Medulla Oblongata.*—In the medulla oblongata the blood vessels in various scattered regions show more or less dilatation and infiltration of the adventitial lymph spaces. The infiltrative cells consist for the most part of small lymphocytes. These vascular changes are most marked in the vessels entering the lateral and antero-lateral surfaces of the medulla. With the fat stains, in all the vessels observed, one may note a considerable increase in all the adventitial cells. In the cytoplasm of these cells large numbers of small and medium-sized fat granules are to be seen so that the vessel wall appears infiltrated with fat. However, all of the fat is intracellular. Immediately surrounding many of these vessels rather large fat granular glia cells appear, most of them lying in the adventitial lymph space. But in every instance there are a few to be seen in the nerve tissue, somewhat removed from the blood vessels. There



are no hemorrhages free in the tissues and no scattered invasion of nerve tissue by obvious lymphocytic elements such as are observed in the cord. Of the ectodermal tissue, the nerve cells of the hypo-

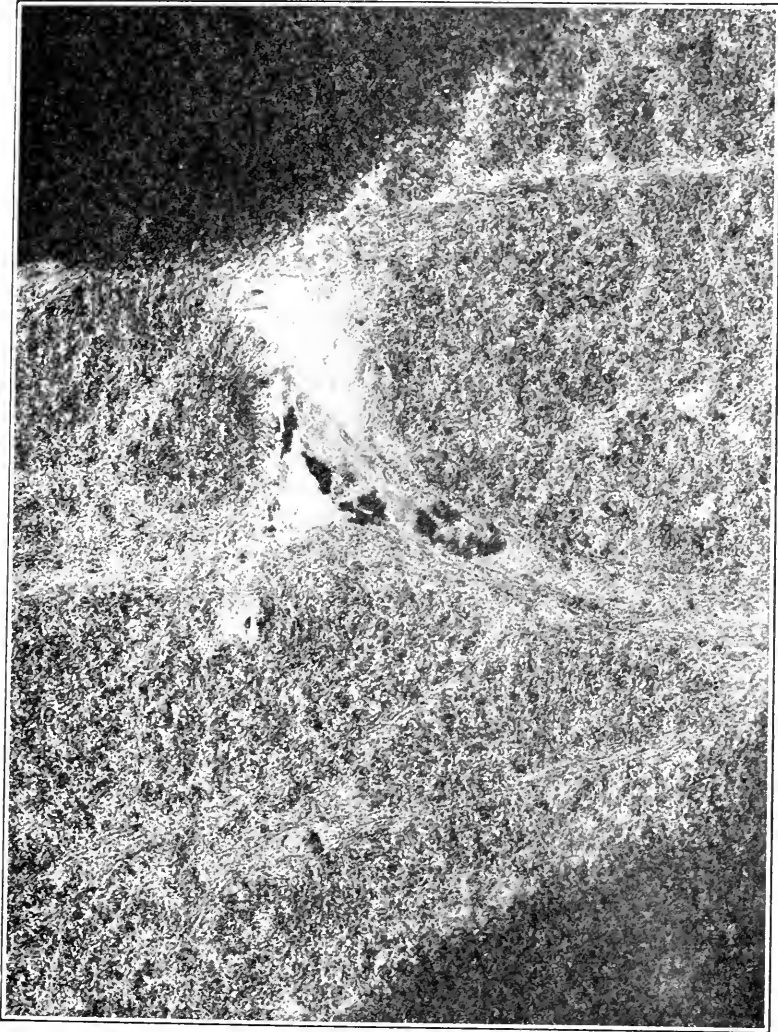


FIG. 8. Section of medulla. Human case No. 501.  $\times 300$ , showing fat-laden cells in adventitial space of a blood vessel.

glossal nucleus and nucleus ambiguus as well as the smaller cells of the reticular formation and those of the olivary nucleus appear normal in shape and in histological structure. The neuroglia cells are increased in number and fat granular, glia cells are to be seen

in considerable numbers. In the reticular formation and other areas where white and gray are intimately mixed this last condition is not generally widespread, but it is seen best in isolated areas of irregular size, which seem to bear no particular relation to the blood-vascular supply or to the large masses of gray matter. The white fibers everywhere appear normal.

*Pons*.—In the pons very little pathological change is to be seen. In the blood vessels there is little if any vascular infiltration. Here and there adventitial cells are seen which contain fat droplets, but this is hardly more than one would expect to find in an individual who had died as a result of a fever. Slight evidences of hyperemia are not lacking. The nerve and neuroglia cells appear normal in all respects. There is no particular increase in the neuroglia, nor are changes in the nerve fibers observed.

### *Cerebellum*

*Pia Mater*.—The pia over the cerebellum shows marked hyperemia with edema and in places hemorrhage into the lymph spaces. In some areas there are also evidences of sub-pial hemorrhage separating the pia from the underlying cortex. In the large lymph spaces which are free from lymphocytes one finds an increase of the connective tissue cells and here and there a small lymphocyte, but massive lymphocytic infiltration does not exist.

*Cerebellum*.—The cerebellar tissue itself shows no changes either in the blood vessels, the Purkinje cells, glia cells or fibers.

### *Cerebral Hemispheres*

*Pia Mater*.—The pia shows hyperemia, edema and hemorrhage, as is seen in that over the cerebellum.

*Pallium*.—The blood vessels of the cortex show considerable hyperemia. The lymph spaces appear normal and contain no infiltrating elements. The cortex itself shows considerable edema, especially in the immediate neighborhood of the blood vessels and in the deeper layers—a condition more marked in the white matter. The ganglionic and neuroglia cells appear normal. There is no neuroglial hyperplasia and the nerve fibers are unchanged.

CASE 2. Serial No. 502. Source, Willard Parker Hospital. Material: From spinal cord, cerebellum and cerebral hemispheres.

### *Spinal Cord*

*Pia Mater*.—The pia is enormously thickened, being from three to five times the normal thickness. There is marked hyperemia, considerable edema and much blood lying free in the lymph spaces. There is a proliferation of connective tissue cells with but little increase in the fibers. Over the anterior surface of the cord there is a moderate fibrinous exudate containing a considerable number of cells, mostly large and small lymphocytes. A surprisingly small amount of infiltration of the pia with lymph elements is seen and throughout the widened lymph spaces red blood cells predominate.

502	Blood Vessels	Peri-vascular Infiltration	Diffuse Infiltration	Hemorrhage	Edema	Neuronal Cloudy Swelling	Neuronal Disintegration	Neuronal Disappearance	Cavitation	Types of Neurophagocytes		Proliferation of Neuroglia
										Neurophagocytes	Neurophagocytes	
Cord: Pia.....	Marked congestion	None	Slight	Marked	Very marked							
Anterior horn.....	Congested	Slight	Slight	None	Slight	Extreme	Advanced	Slight	None	None		Marked
Posterior horn.....	Slight congestion	None	None	None	None	Slight	None	None	None	None		None
White matter.....	Normal	None	None	None	None							
Dorsal root ganglia.....												
BRAIN STEM.....												
Cerebellar pia.....	Congested	Slight	Moderate	Moderate	Marked	None	None	None	None	None		None
Cerebellum.....	Congested	None	None	Marked perivascular	Moderate							
Cerebral pia.....												
Pallidum.....	Congested	Slight	Moderate	Moderate	Marked		None	None	None	None		None

*Anterior Horn.*—The blood vessels of the cord show hyperemia but no change in the vessel walls. The Virchow-Robin lymph spaces are everywhere moderately infiltrated with lymphocytes, mostly of the small variety. Occasionally a polymorphonuclear leucocyte is seen.

*Ganglionic Cells.*—In the gray matter of the cord the ganglionic cells of the anterior horn show pronounced degeneration. Most of them have already disappeared and those which remain show advanced, acute cloudy swelling, with other acute degenerative phenomena, such as vacuole formation, ruptures in the continuity of the cell membrane, and acute breaking up of the cell body with irregularly shaped nuclei. The neuroglia cells have undergone considerable proliferation and the gray matter of the anterior horns seems to be made up for the most part of glia nuclei. Active neurophagy is nowhere to be seen, for the degeneration of the nerve cells seems to have taken place without the participation of the glia. Polyblasts appear in small numbers scattered among the neuroglia cells. In this case it does not appear that the increase of neuroglia is confined in clump-like fashion to those areas of the anterior horns in which nerve cells have been present, but the neuroglia-cell proliferation seems to be rather diffuse throughout the entire gray, involving the anterior horn much more than the zona intermedia or the posterior horn.

*Posterior Horn.*—The cells of the column of Clarke seem normal and singularly well preserved in the otherwise abnormal gray matter. The white matter does not seem to be involved in the pathological process.

### *Cerebellum*

*Pia Mater.*—Over the cerebellum the pia presents a picture quite similar to that observed in the cord with moderate edema and hemorrhage, considerable fibrinous exudate and large numbers of small lymphocytes lying in the lymph spaces around the blood vessels and in the exudate mass. The cells seem here to be almost exclusively lymphocytes, but here and there one meets a polymorphonuclear leucocyte or a large mononuclear cell, probably belonging to the wandering connective tissue cell group. Hyperemia and free hemorrhage in lymph spaces is a common finding.

*Cerebellum.*—In the cerebellar cortex, little that is abnormal is seen except a moderate hyperemia. There is no apparent change in the ganglionic or neuroglia cells. The white matter itself appears normal but the blood vessels show marked hyperemia with massive perivascular hemorrhages and in places red blood cells free in the tissues. There is no infiltration of the vascular lymph spaces. The Purkinje cells are normal.

### *Cerebral Hemispheres*

*Pia Mater.*—The pia overlying the convolutions show changes exactly similar to those described in the cerebellum.

*Pallium.*—In the cortex there is considerable hyperemia, es-

pecially of the small blood vessels, and, as was seen in the cerebellum, this condition is still more prominent in the white matter. In the pyramidal cells of the cerebral cortex a moderate degree of acute cloudy swelling is seen with signs, in places, of a more severe degenerative process and slight increase in the neuroglia cells and beginning neuronophagy, especially in connection with the large pyramidal cells.

CASE 3. Serial No. 503. Source, Bellevue Hospital. Material: From spinal cord.

### *Spinal Cord*

*Pia Mater.*—The pia is moderately hyperemic and markedly edematous with irregular patches of fibrinous exudate lying upon it, for the most part, over the anterior and lateral surfaces. The lymph spaces are surprisingly free from infiltrating cells. Those which are seen are scattered and are exclusively small lymphocytes.

*Anterior Horn.*—The branches of the anterior spinal arteries show moderate lymphocytic infiltration of the lymph spaces. Hyperemia is nowhere marked. There are no free hemorrhages. The white and gray matter of the cord presents edema to a striking degree.

*Ganglionic Cells.*—The nerve cells of the anterior horns in places appear singularly normal, while in others the cells appear to be broken up, staining faintly with pale, degenerated nuclei and irregularly broken cell membranes. One is impressed with the fact that the majority of motor cells of the anterior horn have disappeared by means of this breaking-up process, while those which remain look normal and well preserved. Here again the ganglionic cell degeneration has taken place quite independently of the neuroglia, for there is little or no neuroglial proliferation to be seen anywhere. Sections of this cord stained with the selective fat stains show that the degeneration process is limited almost exclusively to the lateral part of the anterior horn, from which most of the motor cells have disappeared. The cells of the ventral median group have likewise been destroyed. In these two areas we find the adventitial cells of all the blood vessels packed with fat granules and some fat droplets lying free in the Virchow-Robin spaces. Scattered through these portions of the horns there is a moderate increase of glia cells, many of which contain fat granules in varying number. This multitude of fat granular glia cells is diffusely scattered in the degenerated areas but always more numerous in the region of the blood vessels.

*Posterior Horn.*—The blood vessels of the posterior and lateral group appear normal with normal Virchow-Robin spaces. The ganglionic cells are unchanged and there is no cellular infiltration of neuroglia proliferation.

*White Matter.*—The white matter is normal.



CASE 4. Serial No. 504. Source, Roosevelt Hospital. Material: From spinal cord, brain stem and cerebral hemispheres.

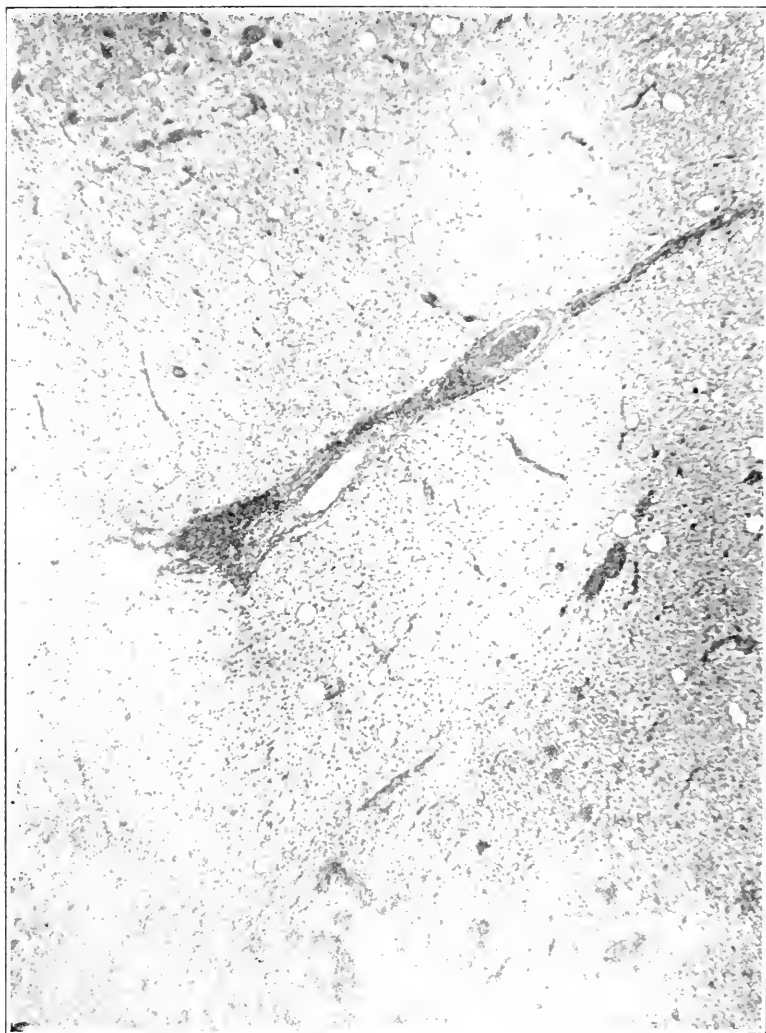


FIG. 9. Section of spinal cord. Human case No. 504.  $\times 150$ . Infiltration of pia in anterior spinal fissure.

### *Spinal Cord*

*Pia Mater.*—The meninges are considerably thickened and there is a large amount of fibrinous exudate lying both on the surface of the pia and in the pial lymph spaces. Around the anterior spinal artery and its branches there is considerable exudate and in this





area the cell infiltration is the greatest. In the neighborhood of the posterior spinal arteries much less evidence of inflammatory change is seen. There is a very striking absence of lymphocytic infiltration of the pia except in the region of the anterior spinal



FIG. 10. Section of anterior horn in human case No. 504,  $\times 150$ , showing acute chromatolysis without neuronophagy.

artery. What infiltrating cells are seen are mostly small lymphocytes with an occasional plasma cell.

*Anterior Horn.*—In striking contrast with this is the cellular infiltration of the vascular lymph spaces of the spinal cord. Prac-

tically all of the vessels of the cord show evidences of this inflammatory reaction in the Virchow-Robin lymph space, always most marked in the distribution of the anterior spinal artery. Here again the infiltrating cells consist mostly of small lymphocytes, with one

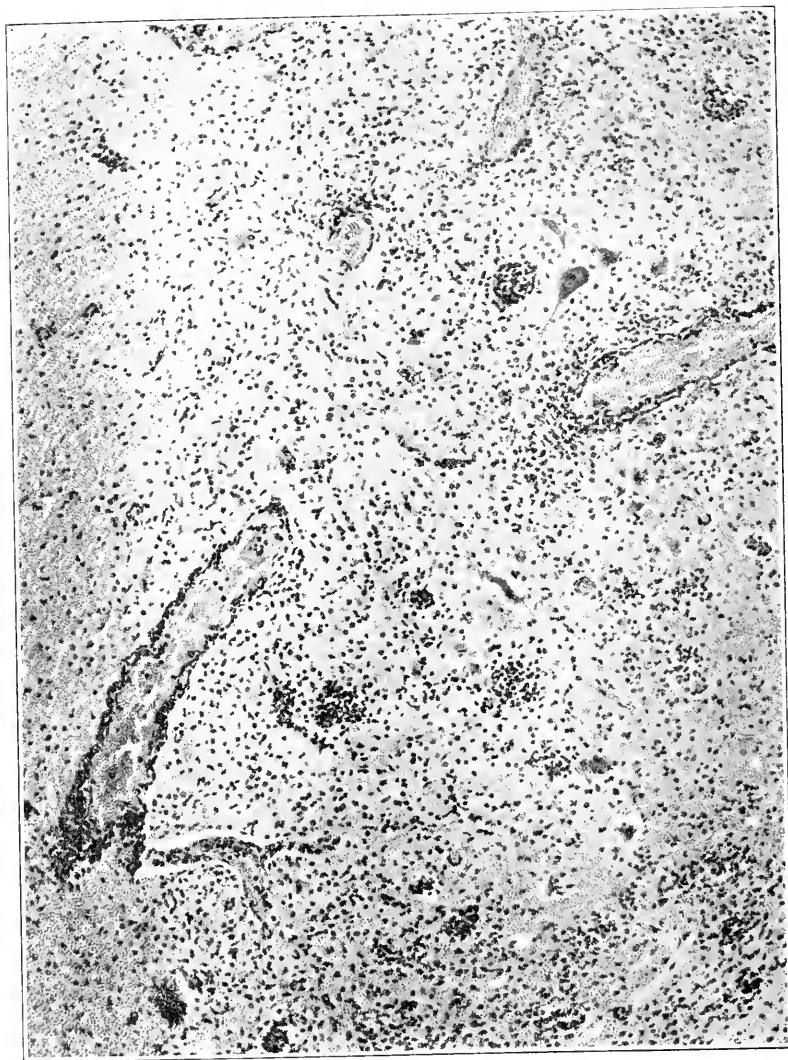


FIG. 11. Section of anterior horn. Human case No. 504,  $\times 150$ . Intense and predominant neuronophagy with disappearance of the cells.

or two plasma cells to be seen in each vessel section. There is no fresh hemorrhage anywhere in the spinal cord, nor does it appear that the lymphocytes have made their way out of the lymph spaces to

lie free in the tissue. The nerve cells of the anterior horn show a variable picture. In some segments no anterior horn cells are to be seen at all. In others the cells are swollen and present all the evidences of acute, cloudy swelling. Again some cells appear normal. The usual picture is that of low-grade acute cloudy swelling. Most striking of all the changes in the gray matter is the massive neuronophagy which seems to be brought about by the polyblasts of Maximow, although undoubted ameboid glia cells are to be seen in considerable numbers. There seems to have been a very decided selective action of this process of neuronophagy. The cells in which this phenomenon are seen are so far degenerated that little if anything remains of the cell bodies and one finds in place of the ganglionic cell, a densely packed clump of cells with small irregular, sometimes multilocular nuclei. Undoubtedly polyblasts form the largest number of these and among them, especially around the border, there are a number of neuroglia cells with large faintly stained nuclei. In cord segments where the above-described picture is observed one sees very few nerve cells, and those in a fairly advanced stage of acute cloudy swelling. Not only are motor cells affected, but also cells of the intermediate zone, lateral and posterior horns. It is rather striking that in this case there are no signs of beginning neuronophagy, but only the most advanced stage of this process. Those cells which have been affected by the disease apparently have been overcome immediately by the sudden onslaught of phagocytes, mostly polyblasts. There is little evidence of degeneration elsewhere than these cells and those cells which have escaped the action of the phagocytes show only such changes as one would expect to find in a febrile disease. Striking also is the absence of fat granular cells and the absence of fat in the adventitia of the vessels. It would appear that in this case there has occurred a severe acute reaction of the lymph tissue as manifested by the massive infiltration of the lymph spaces of the cord, and a secondary severe cell degeneration in places with an equally active proliferation of phagocytic elements, mostly polyblasts, which phagocytosis has been accompanied in some other way than by the usual fat metabolism degeneration.

*Posterior Horn.*—The changes in the posterior horn are less marked than those of the anterior horn. The blood vessels are congested and there is moderate infiltration of their lymph spaces. Hemorrhages are not present and there is but slight edema. Throughout the entire posterior horn there is a moderate diffuse cellular infiltration. These cells are nowhere collected into groups, as is seen in the anterior horn.

*Ganglionic Cells.*—The cells of the column of Clarke alone appear normal. The remaining posterior horn cells show acute cloudy swelling. There is nowhere evidence of neuronophagy.

*White Matter.*—The white matter is normal.

*Medulla Oblongata.*—Over the medulla oblongata the pia, while showing changes quite similar to those at the cord, is affected to a less degree. All of the blood vessels show, as in the cord, a marked

infiltration with lymphocytes and a few plasma cells, which appear for the most part in the dorsal half. This is especially so in the subventricular central gray and region of the nucleus ambiguus. Here likewise is the hyperemia greatest and especially in the central gray. Many spots of fresh hemorrhage are seen, for the most part lying in the nucleus triangularis descendens (Schwalbe's vestibulara). In the nerve tissue one sees in the nucleus of the twelfth nerve little that is pathological except a very low grade of cloudy swelling. The same is to be seen in the olivary nuclei. The nucleus ambiguus, however, presents a picture quite comparable to that described in the anterior horns with the rapid disappearance of the larger nerve cells whose place is taken by the same massive collection of polyblasts described before. Except in this region the neuroglia cells seem to be but little increased and the white matter is apparently normal. As in the cord, the fat, both intra- and extracellular, is practically absent.

### *Cerebral Hemispheres*

*Pia Mater.*—The most striking observation is the massive meningitis affecting mostly those portions of the pia lying on the surface of the convolutions, while in the pia which covers the surface deeper in the fissures but little pathological change can be seen. In the superficial pia one finds edema and a thick layer of fibrinous exudate. Fresh hemorrhage has occurred into the tissue spaces but there is practically no lymphocytic exudate. These changes are always most marked around the larger pial vessels and at the superficial ends of the fissures, in which places the pia is increased to eight or nine times the normal breadth. The blood vessels of the pia seem normal except for congestion and those shorter ones which penetrate the cortical substance likewise show congestion and a very small amount of lymphocytic infiltration in the lymph spaces.

*Pallium.*—The neuroglia is not increased in amount and the pyramidal cells do not appear to have participated in the poliomyelitic process, for they show, as do the affected cells elsewhere in the nervous system, only the low-grade cloudy swelling of a febrile state. The white fibers appear normal and there is no increase of fat in the vessel walls.

(To be continued)

## FAMILIAL PROGRESSIVE MUSCULAR ATROPHY IN ADULTS\*

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The Werdnig-Hoffman type of familial progressive muscular atrophy of childhood has been described so frequently, both clinically and pathologically, as to be accepted as a definite type with fairly uniform findings. On the other hand, though progressive muscular atrophy as a familial affection in adults has been described a number of times, the variation in its clinical findings, and especially the lack of pathological studies in most of the cases, and the difficulty in determining in any case, without autopsy, that the atrophy is really of myelogenous origin, leaves the status of familial progressive muscular atrophy in adults in distinct doubt.

Von Leyden<sup>1</sup> described an hereditary form of progressive muscular atrophy which he distinguished from the non-hereditary by its appearance in several members of the same family, the lack of any known cause, its preference for children and for the male sex, and its beginning in the muscles of the back and buttocks. His statement that the atrophy is often not recognized at its first appearance, owing to the development of large quantities of fat, makes one suspect that he had not excluded cases of muscular dystrophy where hereditary predisposition is universally recognized as common.

Möbius<sup>2</sup> also referred to hereditary progressive muscular atrophy, but attempted to distinguish between pseudo-hypertrophy with fat deposit and true atrophy. He noted that the muscles of the back and lower extremities are usually first affected, and gave this as an important sign of the hereditary form.

Eichorst,<sup>3</sup> in 1873, referred to a number of doubtful contributions on heredity in progressive muscular atrophy and reported a family where, in six generations, out of thirty-one members charted,

\* A contribution to the William Leonard Worcester Series of Danvers State Hospital Papers, presented November 19, 1915.

<sup>1</sup> Von Leyden, Bd. II, S. 5 (25).

<sup>2</sup> Möbius. Sammlung klinische vorträge, herausgegeben von Dr. R. Volkmann, No. 171.

<sup>3</sup> Eichorst. Berliner klin. Wochenschrift, Bd. X, No. 42 u. 43, Oct. 20 u. 27, 1873.

thirteen were affected with what the author called progressive muscular atrophy. In all instances the trouble began with atrophy of the calves and the feet, spreading later to the hands. Some suffered pain, others had none. Though it is impossible to determine the exact nature of these cases without anatomical evidence, the reference to the voluminous muscles and the lack of fibrillary twitching strongly suggest that they were of myopathic origin.

Strümpell<sup>4</sup> reported a patient, forty years of age, who, eleven years previously, developed an atrophic paralysis of the small muscles of the hands, and who, at the time of the report, had a high-grade atrophy of the muscle fibers of both upper extremities. The legs were not affected. The mother had had a similar affection.

Gowers<sup>5</sup> gives a brief statement that direct inheritance in progressive muscular atrophy is rare, but that among other instances he has seen a lady affected with this ailment whose mother died from a similar atrophy. In another case of atrophy, a brother of the patient had died of some chronic disease of the cord attended with wasting. Gowers states that cases of direct inheritance occur late in life.

Osler<sup>6</sup> reported a family with hereditary progressive muscular atrophy where thirteen individuals were affected in two generations. The trouble began at from less than twenty up to fifty-nine years of age, and the illness lasted from two to several years. In the case especially reported the trouble began in the left thigh and buttock and, when seen, the atrophy was greatest in the gluteal and hamstring muscles, but the fibrillary twitching was seen in the trunk and in all the extremities. There was no pain but sensation was less acute than normal in the legs. Osler classified his case as of the Werdnig-Hoffman type of progressive muscular atrophy.

Zimmerlin<sup>7</sup> reported seven cases of familial progressive muscular atrophy, four in one family and three in another. In the first case of the first series the trouble seems to have been originally observed as a weakness in the back, and a tiredness in standing, but in all the other cases the motor signs were limited to the region of the arms and shoulders, and, even in the first case, the objective signs were found only in these regions. There was no sensory trouble, no involvement of the intrinsic muscles of the hands, no fibrillary twitching and no lipomatosis. The trouble was mostly double-sided. Zimmerlin noted the difference between these cases and those of the Leyden-Möbius type.

<sup>4</sup> Strümpell. *Deutsche Zeitschrift f. Nervenheilkunde*, Bd. III, S. 471.

<sup>5</sup> Gowers. *Diseases of the Nervous System*, Vol. I, 2d edition, p. 472.

<sup>6</sup> Osler. *Arch. Med.*, Vol. IV, No. 3, December, 1880.

<sup>7</sup> Zimmerlin. *Zeit. f. klin. Med.*, Bd. VII, S. 15, 1884.

The second series was much like the first, except that case seven resembled more the Leyden type. The author concluded that these cases might be etiologically and genetically identical, even though differing as to whether of the arm or leg type.

Hammond<sup>8</sup> reported a family with six cases of known progressive muscular atrophy. In the case especially studied the trouble began in the right anterior thigh at thirty-nine years of age, with fibrillary contractions. A few months later the trouble appeared in the left thigh, and at the time of writing both arms and both legs were involved and coughing and sneezing were impossible. There was no sensory trouble except "painful cramps" in both thighs accompanying the atrophy. In the patient's father the trouble had developed at the same age and in a similar location, but in a sister the trouble is said to have begun in the left arm and shoulder.

Bernhardt<sup>9</sup> reported five cases (cousins), in whom a progressive muscular atrophy began in the neck and shoulders, but in one there was a history of syphilis with hemiplegia (case 1).

Hoffman<sup>10</sup> gives four types of hereditary progressive muscular atrophy as follows: (1) Occurring in the early years of childhood, beginning at the pelvic girdle and going to the extremities (Werdnig-Hoffman type); (2) infantile bulbo-paralytic face type (according to Fazio, Londe); (3) Duchenne-Aran type (Strümpell, Gowers); (4) transitional type (Bernhardt). Hoffman states that he makes this arrangement not because it is really satisfactory, but in view of the relation of the atrophies to the dystrophies and because it makes their diagnosis somewhat easier.

Etienne<sup>11</sup> divided muscular atrophy of myelopathic origin into three groups of which the third is the hereditary type. In the case described under the latter heading the illness began with weakness of the right thumb and later involved the legs, the arms and the muscles of the throat. The hereditary feature in this case does not appear to be very clearly determined, as it depends on the statement that the father had a "taint of infantile paralysis," and a paternal aunt had "infantile paralysis."

Bruining<sup>12</sup> described two cases of chronic anterior poliomyelitis, occurring in father and son. In the former the trouble began in the anterior muscles of the right thigh, and subsequently followed a course not unlike that in my own case. Death occurred from pneu-

<sup>8</sup> Hammond. *Diseases of the Nervous System*, 8th edition, p. 540, 1886.

<sup>9</sup> Bernhardt. *Virchow's Archiv*, Bd. 115, p. 197, 1889.

<sup>10</sup> Hoffman. *Deutsche Zeitschrift f. Nervenheilk.*, Bd. X, S. 292, 1897.

<sup>11</sup> Etienne. *Nouv. Icon. de la Salp.*, Vol. XII, p. 358, September and October, 1899.

<sup>12</sup> Bruining. *Deutsche Zeits. f. Nervenheilk.*, Bd. XXVII, 1904, S. 269.

monia eighteen months after the onset of the atrophy. The trouble had spread rather generally throughout the body and had reached the bulb previous to the onset of the final illness. In the son the first symptom noted was weakness in the neck, and, up to the time of death, from lung trouble, the lower extremities had remained free. In this case there was pain, but no other sensory phenomenon.

Fuchs<sup>13</sup> reported a father and son, the former fifty-six and the latter sixteen years old, who developed weakness, atrophy and fibrillary tremor in one upper extremity. Both had pain in the affected area and there was loss of faradic response and presence of reaction of degeneration, but no objective disturbance of sensibility. In the father the muscles of the shoulder girdle, arm, forearm and hand were affected. In the son only the shoulder and arm muscles were involved at the time of the report. Fuchs regards his cases as instances of poliomyelitis.

Dana<sup>14</sup> reported a nurse, fifty-three years of age, who, in January, 1913, first noticed a weakness of the left thigh. In April there was atrophy of the extensors of the left thigh and some weakness in flexing and extending the left foot. The left knee jerk was absent and there was R. D. in the left quadriceps muscle. No fibrillary tremor and no sensory trouble was noticed. The mental condition was normal except that the patient's attitude was said to be remarkably placid in view of the trouble. The Wassermann reaction was negative and the urine, heart and blood vessels all normal. On June 5 both thighs were found involved and there was some weakness of the muscles of the fingers of the left hand. In July her arms were reported as becoming weaker, and she died November 4. There was no autopsy. Of twenty-two members traced in this family, ten, besides the patient, died of a progressive paralysis. In these ten the disease began three times in the fingers and arms and once in the leg. No statement is given in respect to the others. Dana classifies his case as a new, adult type of spinal myopathy.

Taylor<sup>15</sup> describes a family in which, after the age of fifty, a slowly developing paralysis of the muscles of deglutition takes place with coincident ocular ptosis, but without other involvement of cranial nerves. Death occurs from starvation. So far as could be ascertained, five individuals in two generations were involved. Four have died.

Finally, in addition to these more or less clear instances of

<sup>13</sup> Fuchs. *Jahr. f. Psych. u. Neurol.*, Bd. 31, Hft. 1, 1910, S. 195-199.

<sup>14</sup> Dana. *JOURNAL NERVOUS AND MENTAL DISEASE*, Vol. 41, No. 11, November, 1914.

<sup>15</sup> Taylor. *Idem*, Vol. 42, No. 1, January, 1915.



familial progressive muscular atrophy, another type is seen in such cases as those of Seligmüller,<sup>16</sup> Higier,<sup>17</sup> Holmes,<sup>18</sup> Bertolotti,<sup>19</sup> Lange<sup>20</sup> and my own,<sup>21</sup> where, along with amyotrophy, there appear in combination such conditions as nystagmus, strabismus, cataract, optic atrophy, bradylalia, difficult deglutition, diplegia, epileptic convulsions and progressive diminution of intelligence.

CASE REPORT.—H. L. Male, age 30 years, white, single, fireman.

*Family History.*—The great-grandfather, on the maternal grandmother's side, died when past ninety. He had ten children, all of whom lived to old age, except one daughter, who was the patient's maternal grandmother. She died at fifty-five of a progressive motor weakness. The initial symptom was an inability to talk plainly. Later the weakness spread to her body and for three months previous to her death no movements of the tongue had been possible and she could not swallow well. Five months after the onset of the illness she died of starvation. The maternal grandfather died at fifty-four of peritonitis. These grandparents had four sons and five daughters, the record of whom is as follows:

1. Female—was supposed to be well up to February of her fortieth year. Then, without any premonitory symptoms, she fell one day in trying to get out of a buggy. Subsequently one of her thighs was found to be weak. This weakness spread to the corresponding leg, then to the opposite thigh and leg, and then to her arms. At the end of about one year she died of "heart involvement." There is said to have been no trouble in talking or swallowing. She had eleven children, of whom three have died, but none of any illness like the mother's. Eight are living and well, and the oldest is over forty.

2. Died in infancy of lung trouble.

3. Died in infancy of lung trouble.

4. Female—living and well, except for some difficulty in going upstairs, of long duration and not progressive. She had one son (present patient) and two daughters. The daughters are living and well at twenty and twenty-four years of age.

5. Male—living and well at forty-eight. He had one child which died in infancy.

6. Died in infancy of measles.

7. Male—living at forty-eight, with three healthy children. He has had considerable joint trouble, which is believed to be tuberculous.

8. Female. In her forty-third year she developed a weakness of both thighs, simultaneously. This spread upward and involved the arms, and later the muscles of the throat, so that she could not speak or swallow. Death occurred after nine months, and was said to be

<sup>16</sup> Seligmüller. *Deutsche med. Woch.*, 1876.

<sup>17</sup> Higier. *Deutsche Zeits. f. Nervenheilk.*, 1896.

<sup>18</sup> Holmes. *Rev. Neurology and Psychiatry*, April, 1905.

<sup>19</sup> Bertolotti. *Nouv. Icon. de la Salpêtrière*, March-April, 1910.

<sup>20</sup> Lange. *Deutsche Zeits. f. Nervenheilk.*, Bd. 40, 1-2, 1910, S. 65.

<sup>21</sup> Hamilton. *Review of Neurology and Psychiatry*, December, 1911, p. 645.

due to starvation. According to her physician she had "progressive muscular atrophy, with bulbar symptoms." One daughter died in infancy of intestinal trouble. One son is living and well at twenty-eight.

9. Male—living at forty-five, but not well. Has had a great deal of pain from a condition which is supposed to lie in the cervical spine. Two children are living and well.

Patient's father died at forty-four, of cancer of the stomach.

*Personal History.*—The patient was born in Wisconsin and worked as a farmer up to two and one half years ago, after which he was a locomotive fireman until the onset of the present illness. He has been a moderate smoker since twenty-five years old, but denies syphilis, drugs, or any excessive use of liquor. Three years ago he had an attack of gonorrhea lasting six weeks and causing little trouble. Very early in life he had measles, chickenpox and mumps; otherwise his health has been unusually good. For some years in early life there was a distinct tendency to inversion and slight dragging of the right foot, and he wore a brace. Even up to the present there has been a special tendency to wear out the anterior and inner aspect of the right shoe.

In March, 1911, he first noticed a weakness of the muscles of the anterior aspect of the left thigh, with severe pain in all the muscles of the upper and lower extremities, and a little pain in the small of the back. This pain remained about one and one half months and was constant and aching in character and especially pronounced at night. The muscles were not tender and there was no chill or fever. His trouble was diagnosed as rheumatism, and he took a variety of anti-rheumatic remedies.

In May, 1911, some atrophy of the muscles of the anterior portion of the left thigh was first observed. In June there was some improvement, but in July he again noticed a weakness of the left thigh, though with no recurrence of pain. At this time he began to lose power in the left anterior tibial muscles also. He continued at his work as fireman, but noticed that the left thigh and leg were growing progressively weaker and smaller. In October he gave up his work and took to crutches; as the left leg would give way at times when he put weight on it. At this period he also noticed that in walking he would have to swing the left lower extremity in order to bring it forward.

When first seen, November 2, 1911, he had begun to suspect a growing weakness in the left hand and arm. This had begun in the left little finger. He had no pain at this time, and there was no loss of sensibility; in fact, he thought the left leg rather more sensitive than the right.

*Physical Examination.*—When examined November 2, 1911, he was found to be a well-nourished man and well developed except for the atrophy mentioned below. His temperature was 98.6, pulse 76, soft and easily compressible. The arterial walls were not thickened. The skin was slightly moist and there was no eruption or edema. There were a few small palpable glands in the right posterior triangle of the neck, but the epitrochlears, axillaries and in-

ginals were not enlarged. The teeth were in fair condition, but not clean. The tonsils were not enlarged. The heart and lungs, abdomen, pelvis and sexual organs were entirely normal, except that the left epididymus was slightly firmer than the right. All the cranial nerves were normal, except that for years there had been some deficiency in smell. No sensory disturbance could be made out at that time or at any later period.

When the left foot and leg were placed in a dependent position they rapidly became congested and in a short time distinctly bluish.

There was a very marked wave-like fibrillary tremor in the left quadriceps muscle, especially toward the lower end of the vastus internus. This tremor was also prominent in the left triceps, biceps, deltoid and trapezius muscles. It was moderate in the left hip and slight in the right biceps, triceps, and deltoid muscles.

The motor power of the muscles of the head and neck and of the right upper and lower extremities was about normal. There was very marked atrophy and no apparent power in the muscles of the left buttock, and left anterior thigh group. Adduction was very weak in the left thigh and abduction was scarcely noticeable. He flexed and extended the left foot and left toes to a slight degree. A contraction could be palpated in the left anterior tibial group, but not in the left calf. There was very little atrophy of the left leg. He had only slight power in the left triceps, but the left biceps and deltoid acted fairly well, and the left pectoral muscles were normal in power. All movements of extension were impaired in the left fingers and this was especially so in the left little finger. He approximated the left thumb to the fingers feebly, and there was evident atrophy of the left thenar and interossei muscles. The grip in the right hand was 30 and in the left hand 20. The following measurements were taken:

Right biceps .....	29 cm.	Right lower thigh .....	37 cm.
Left biceps .....	27 cm.	Left lower thigh .....	33 cm.
Right forearm .....	27 cm.	Right calf .....	32 cm.
Left forearm .....	24¾ cm.	Left calf .....	32 cm.

The left biceps and triceps reflexes were faint. The right biceps and triceps and both supinator jerks were normal. The right patellar reflex was a little diminished and the right Achilles was faint. The left patellar and Achilles jerks were not obtained. There was no ankle or patellar clonus. The jaw reflex was active. The plantar reflexes were faintly flexor. Both abdominal reflexes were faint.

December 3, 1911. The patient had grown weaker and the area of involvement was greater. The grip in the right hand was 26 and in the left 10. He was unable to extend the left little finger fully or as well as the others. Measurements taken at this time were as follows:

Right biceps .....	29 cm.	Right lower thigh .....	36 cm.
Left biceps .....	26½ cm.	Left lower thigh .....	33¾ cm.
Right forearm .....	27 cm.	Right calf .....	30¾ cm.
Left forearm .....	24¾ cm.	Left calf .....	30¾ cm.

A lumbar puncture showed a clear cerebro-spinal fluid with moderately increased pressure. The Wassermann and Nonne responses were negative. The cell count showed 8 small mononuclear cells.

December 15, 1911. The patient was conscious of his growing weakness and was considerably disturbed by it. The grip in the right hand was 27 and in the left hand 5. There was a pronounced fibrillary tremor of the left biceps and thenar muscles, of the extensors of the left forearm and of the right quadriceps and a slight tremor of the tongue and right biceps. There was almost no power in the left triceps and only fair power in the left biceps and deltoid. The left pectorals were normal. There was no power of approximation of the thumb and fingers of the left hand. The left little finger had no power of extension and remained constantly half flexed. The thumb and remaining fingers could be extended, but only weakly. Flexion was better than extension in the thumb and fingers, including the little finger, but was much less than normal. There was a well-marked atrophy of the left thenar eminence, less marked of the left hypothenar eminence. Flexion and extension of the left toes and left foot was very faint and on some days could not be obtained at all. The left Achilles jerk was faint and the right was almost normal. The right patellar was normal and the left was not obtained. The left supinator jerk was a little diminished. The deep reflexes of the right arm were normal. The tongue was protruded straight and was not atrophied, but there was a moderate fibrillary tremor. There was a well-marked and frequent sweating of the left foot. The measurement of the thighs and calves, about the same as at the last note, was as follows:

Right lower thigh .....	36 cm.	Right calf .....	30½ cm.
Left lower thigh .....	33½ cm.	Left calf .....	30 cm.

December 22, 1911, the left foot still sweat more or less all over, but especially on the sole. There was slight power of extension of the foot on the leg, but practically none of flexion. He was able to move all the toes of the left foot, though feebly. There was very distinct atrophy of the intrinsic muscles of the left hand. For a few days past there had been definite soreness of the flexor muscles of the left forearm and some fibrillary tremor in these muscles, but more in the extensors.

January 1, 1912. The patient said that for some days he had had considerable pain in the region of the masseter muscles and there was a distinct fine tremor in the muscles about the chin. This pain had generally preceded the onset of muscular weakness in each particular region. The fibrillary tremor was very marked in the tongue. Flexion of the toes of the left foot was now very weak. Any attempted movement of the toes was sometimes vertical and sometimes lateral. These movements alternated at short intervals and their direction was beyond the patient's control. No power whatever was noticeable in the left anterior tibial group. Fibrillary tremor was very prominent in the muscles of the posterior region of the left thigh.

The patient was admitted to the hospital of the University of Minnesota, February 13, 1912, and remained there up to the time of his death April 26, 1912. At admission his temperature was 97.8, pulse 108, respiration 24. He could get about with the aid of crutches, but was more comfortable in a supine position and spent most of his time in bed.

A careful physical examination gave the following findings:

His hemoglobin was 70 per cent. and the red count was 6,325,000.

The differential count was as follows:

Lymphocytes .....	28.6 per cent.
Large mononuclear leucocytes .....	15 per cent.
Polymorphonuclear leucocytes .....	50.4 per cent.
Eosinophiles .....	6 per cent.

The systolic blood pressure was 116.

The Wassermann test in the blood was negative.

Urine: Acid, 1.026, no albumin or sugar, many calcium oxalate crystals, a few epithelial cells and leucocytes; no casts.

He was well nourished and well developed, except for the left upper and lower extremities. The teeth were in a fair state of preservation, but there was some infection about the gums. The tonsils were congested, but not enlarged. There was a well-marked fibrillary tremor of the tongue and a slight tremor at times about the nose and the angles of the mouth. The tongue was deflected slightly to the left. Some small glands could be felt in the right posterior angle of the neck. There was a slight dorso-lumbar kyphosis, some atrophy of the left pectoral muscles, and a moderate fibrillary tremor of both groups of pectoral muscles. Expansion was good and equal on the two sides of the chest.

The right arm and shoulder were fairly well developed and all movements in this region were performed with fair power. The right biceps, triceps and supinator reflexes were active. The left shoulder was less well rounded than the right, and the muscles of the left arm and hand were distinctly shrunken and flabby, especially the interossei. The left forearm could be pronated, but not supinated, and could be fully flexed on the arm only by working it up along the chest. It was extended in the same manner by working it down along the chest. The wrist could be flexed but not extended. The second, third, and fourth fingers were constantly flexed and could not be extended. The first finger could be flexed only slightly. There was slight power of adduction and abduction in the thumb, but no flexion or extension. There were no biceps, triceps, or supinator jerks on the left side.

The right leg was fairly well developed and he could adduct and abduct, flex and extend the thigh with fair power. He could also flex and extend the leg and flex and extend, abduct and adduct the foot and move the toes. The patellar, Achilles and plantar (flexion) reflexes were active. There was no clonus. Distinct fibrillary twitching was seen in the thigh, both anteriorly and posteriorly, and in the calf.

All the muscles of the left leg, thigh and hip were atrophied and

very weak. Aside from slight movement at the hip, the only action was a faint flexion of the smaller toes. There was no fibrillary twitching, no ankle clonus, and no patellar, Achilles or plantar reflexes.

Sensation was normal everywhere, except for a possible hyperesthesia in the left lower extremity. Mentality and speech were entirely normal. There was an occasional choking. The following dynamometric tests were made at the dates given, but the instrument was different from that used in the tests described above, and a higher registration was possible on this second instrument. Several tests were made on each occasion.

2-29-12		3-6-12		3-19-12	
Right hand.	Left hand.	Right hand.	Left hand.	Right hand.	Left hand.
46-40	0	42-34	0	42-39	0
3-22-12		4-6-12		4-18-12	
Right hand.	Left hand.	Right hand.	Left hand.	Right hand.	Left hand.
32-22	0	16-12	0	4-2	0

February 20, 1912, at 4 P. M. his temperature was 100, pulse 80, and respiration 20. This was the only rise of temperature registered at any time during his stay at the hospital. Usually the temperature was somewhat subnormal.

March 4, 1912, his weight was 141 $\frac{1}{4}$  pounds. His pulse was slightly increased in rate, and usually registered between 88 and 92. on several occasions subsequently it returned practically to normal, sometimes even for two or three days at a time.

March 27, 1912, a note was made that the right side had failed distinctly in power. An ophthalmoscopic examination showed both fundi pale and the arteries small, but no definite pathological change.

March 31, 1912, he was not sleeping so well. It was difficult for him to get into a comfortable position and he found difficulty in breathing. He complained also of the left arm aching. From this time on, the notes frequently stated "restless at night," or "sleeping only at intervals."

On April 5, 1912, the notes stated that he could not get his breath when lying on either side. April 11, 1912, he was steadily failing. He slept badly and even in the daytime complained of lack of breath. Pulse 96 to 108. He was almost helpless and must constantly be lifted about, though when placed erect he could hold himself so for a short time on the right leg. He still fed himself with his right hand but the movements were feeble and uncertain. When seen he was sitting in a chair and was distinctly cyanotic. When attempting to speak, his breath was short and drawn with considerable effort. Breathing was largely with the right chest. The voice was husky and weak, and distinctly different from normal. He raised the left shoulder slightly and could very feebly flex the second and third fingers and thumb of the left hand. Otherwise there was no power in the left upper extremity. There was almost no power in the right deltoid, but the biceps and triceps were fairly active. He flexed the fingers of the right hand fairly well, but extended the right second and third fingers only partially. Both deltoids were very atrophic, but the left more than the right. The

muscles of the right forearm and arm were moderately atrophic and of the left arm were distinctly atrophic. The left thenar and hypothenar eminences were about equally shrunken. The right biceps and triceps muscles and the right forearm muscles were fairly well preserved, but all intrinsic muscles of the right hand were much shrunken and about equally so among themselves, though much less atrophic than the corresponding muscles in the left hand. In breathing, the right sterno-cleido-mastoid muscle was brought distinctly into action, the left only slightly so. Both pectoral muscles were much shrunken, the clavicular portion much more so than the sternal and the left more so than the right. The masseter muscles contracted firmly and seemed of fair size, but the jaw was forced open against resistance without much difficulty. The facial muscles acted fairly well. The tongue was protruded with some power and was moved from side to side, but was much atrophied and showed a very marked fibrillary tremor. There was some fibrillary tremor in the right upper eyelid, and the patient said it was present at times in the face. There was no diplopia. On turning the eyes to the right a distinct nystagmus developed. It was less active when the eyes were moved to the left and was absent in vertical movements. The pupils were normal. The patient could not bring his chin to the chest and could scarcely raise his head from the bed. The muscles of the right neck anteriorly acted fairly well in this attempt, those of the left very poorly. There was no movement whatever observed in the left foot, leg or thigh, though he insisted that he had slight power in the left thigh in certain positions. Movement of the right foot and right toes was very fair. The right anterior tibial muscles acted better than the corresponding calf muscles, but neither acted well. There was very feeble power in the thigh muscles on the right side. The abdominal muscles seemed weak, but the patient said he passed urine normally and had fair control of bowel action. There was a faint left biceps and forearm jerk, but none could be elicited from the triceps. The right biceps response was absent and the triceps and forearm jerks were fair. The left patellar, Achilles and plantar reflexes were all lacking. The right plantar reflex was faint, but of flexion type. The right patellar and Achilles jerks were very faint. There was no patellar or ankle clonus.

A careful examination for disturbance of sensation failed to reveal any abnormality in touch, pain, temperature, vibration or joint sensibility.

The left buttock was much shrunken and the right moderately so. All muscles about the scapulæ were atrophied, especially on the left side. The right trapezius contracted fairly well. There was a distinct tendency of the skin on the back to break down and a small ulcer had developed over the sacrum. All the extremities were bluish and cold. His weight was 135 pounds.

April 18, his appetite was fairly good, but he had difficulty in getting his breath while attempting to eat. Several times previously he had complained of choking and on this day he brought up considerable mucopurulent material. The previous night he had had a number of successive attacks of difficult breathing.

April 23, he was drowsy some of the time and was very uncomfortable on account of lack of breath and tendency to choke. Was reported as talking in his sleep of late. Pulse 78 to 112.

April 24. Breathing very difficult. Became very tired when placed in a sitting posture in bed, but was afraid to lie down on account of difficulty in breathing.

April 26. Pulse 96 to 120. Was cyanotic and in great distress all afternoon. Choked and gasped when trying to swallow. Even a slight change of position would bring on an attack of dyspnea. His pulse became imperceptible before his respiration stopped. He died at 11:30 P. M.

Dr. H. E. Robertson performed the autopsy April 27, at 1:30 P. M., and to him I am indebted for the opportunity to use the notes.

*External Appearances.*—The body is that of a well-developed, fairly well-nourished adult male, 176 cm. in length. There is very slight rigor mortis and a faint lividity of dependent portions. The pupils are 7 mm. in diameter and equal. There is marked local edema beneath the left lower eyelid. The arms and legs show a fairly pronounced atrophy of the muscles, this being more marked on the left than on the right side. The calves measure 27 cm. in circumference. At a point 16 cm. above the olecranon, the left arm measures 23.8 cm. and the right 25.2 cm. Twenty-seven cm. above the patella, the left thigh measures 40.5 cm. and the right 45.5 cm. The muscles of both hands and feet show atrophy. The arches of the feet are apparently entirely broken down and the hands have a tendency to a claw-like appearance.

*Peritoneal Cavity.*—On making the preliminary incision, the muscles of the chest and anterior abdomen are pale and slightly atrophied. The panniculus adiposus is well developed, measuring 2 cm. in depth over thorax and 4 cm. near umbilicus. The surfaces of the abdominal cavity are free from abnormal fluid or adhesions. Appendix measures 10 cm. in length and lies free. Diaphragm reaches fourth rib on right, fourth space on left. Mesenteric lymph nodes normal.

*Pleural Cavities.*—Free from abnormal fluid or adhesions.

*Pericardial Cavity.*—Contains 7 c.c. of clear fluid. There are white patches of thickening on the epicardium on the posterior surface of the left ventricle, on the anterior surface of the right ventricle, and on the posterior surface of the pericardium near the base.

*Heart.*—Slightly increased in size; weight 359 grams. Cavities are distended with fluid blood. Muscle is pale, soft and light brownish red in color. Foramen ovale closed. Root of aorta and coronaries show patches of thickening.

TV = 15 cm.	PV = 8 cm.	Depth Rv = 9 cm.	Thickness Rv = 5 cm.
MV = 11.5 cm.	AV = 7 cm.	Depth Lv = 8 cm.	Thickness Lv = 1.5 cm.

*Lungs.*—Dependent portions of both lungs dark in color and partially collapsed. Between the lobes are a few diffuse subpleural hemorrhages. Anterior portions expanded and feathery. No evidence of nodules or consolidation.

*Spleen.*—Normal in size, slightly increased in consistency, and



of a slaty color. Cut surface congested; markings indistinct; pulp can be scraped away.

*Liver*.—Slightly decreased in size; weight 1,550 grams. Capsule dark in color and smooth. Surface regular. Consistence normal. Cut surface congested and markings indistinct. Gall bladder contains dark, thick bile. Otherwise bladder and ducts are normal.

*Pancreas*.—Slightly softened.

*Gastro-Intestinal Tract*.—Free from any evidence of lesion.

*Adrenals*.—Cortices narrow and yellow. Medullæ show a brownish semi-fluid material.

*Kidneys*.—Weight about 300 grams. Capsules strip readily, showing dark-colored smooth surfaces. Cut surface congested and dark red in color. Markings regular.

*Bladder*.—Contains a few c.c. of cloudy urine. Mucosa deeply injected. Prostate normal.

*Genital Organs*.—Normal.

*Aorta*.—Shows numerous irregular patches of thickening.

*Organs of Neck*.—Thyroid possibly slightly enlarged, but uniform in shape and appearance. Tongue covered with dark brown coat. Papillæ at base prominent. Tonsils enlarged and firm. Esophagus normal. Glands of tracheal mucosa prominent as pearly dots. Peritracheal lymph nodes not notable except for presence of black pigment.

Examination of the muscles of the abdomen shows marked atrophy of the left psoas, which is soft, pale and contains fibrous cords. Right psoas is of good volume and approximately twice the size of the left.

*Head*.—Scalp, calvarium and dura normal. Brain is apparently normal; weight 1,625 grams. No lesion in middle ears or base of skull.

*Diagnosis*.—(1) Chronic progressive muscular atrophy.

(2) Congestion of kidneys.

(3) Arterio-sclerosis.

The histologic examination included a study of the viscera, the diaphragm, the right and left psoas, the tibialis anticus muscles, the muscles of both thighs, both sciatic and deep peroneal nerves, several posterior root ganglia, the entire cord, and sections from various parts of the brain cortex. The remainder of the brain was not saved.

The following stains were used: Marchi, Sudan III, orange fuchsin, Van Gieson, hematoxylin and eosin, eosin and polychrome methylene blue, Weigert elastic, thionin, Nissl's methylene blue, Weigert and Pal-Weigert myelin sheath stains.

Microscopic examination of the intestines, adrenals and epididymi showed nothing of consequence. There was some congestion of the testicles, liver and spleen, and marked congestion of the vessels of the kidneys in places and some parenchymatous and interstitial nephritis. The prostate was hypertrophied. The pancreas showed an old hemorrhage.

The elastic coats of vessels from different parts of the body were mostly normal. Occasionally there was a thickening of the

intima, and an increase of and tendency to breaking up of the elastic coat. The latter changes were most prominent in a vessel from the anterior fissure of the cord and in some vessels from the pia-arachnoid of the brain.

*Muscles.*—The diaphragm and heart showed no unusual condition. In longitudinal and cross sections of the right psoas, most of the fibers were normal in appearance, but sometimes an entire bundle would show all the fibers swollen and in other instances there would be a patch of swollen fibers in the interior of a large bundle, the outer fibers being normal. The swollen fibers retained their striation, though not so clearly as the normal fibers. There was no visible atrophy or nuclear increase. The left psoas was much more deeply affected (Fig. 1). The swollen fibers were more in evidence than on the right side, and in many places the nuclei were greatly increased and the fibers small, or even in places entirely lacking. The cross and longitudinal striation usually remained even in the swollen fibers, but many times this was broken up and irregularly shaped clear spaces or even clearly outlined vacuoles were seen in the fibers. The muscles of both thighs, but especially the left, showed a very great degeneration of the muscle tissue. In many areas little was seen except connective tissue and fat, and even such fibers as remained appeared abnormal. The nuclei were greatly increased in numbers. Some fibers had a peculiar wavy appearance as if broken from their attachment at one end and then retracted. A piece of muscle from the right anterior thigh region showed several areas of perivascular lymphocytic infiltration, and in at least one instance a cell collection was seen inside a bundle of muscle fibers with no visible blood vessel. These cell groups were made up largely of lymphocytes, with a few polymorphonuclear leucocytes.

Marchi and Sudan III stains showed a marked, but very irregular degeneration of muscle fibers, especially in the right psoas. Many normal fibers remained and these were usually in groups, but even in a group where most of the fibers were normal a few could usually be seen containing granules. The most striking feature of the Marchi muscle sections under low power was the appearance of isolated fibers, usually of medium or large size, filled with black granules (Fig. 2). These fibers varied in appearance from a deep to a pale black. The higher objectives showed many cells, which appeared normal under low power, to be really filled with granules. The granules varied from a very fine dark stippling to granules of considerable size.

*The Spinal Cord.*—There was no special thickening of the pia-arachnoid except for collections of lymphocytes which appeared at intervals throughout the length of the cord. These were most abundant in the cervical and upper thoracic regions, became much less frequent in the lower thoracic region and again increased in the lumbar and sacral regions, but not to the same degree as in the upper part of the cord. They were particularly common in the anterior fissure and at the point where the anterior roots emerged, and were mostly in the perivascular lymph spaces, especially in the anterior

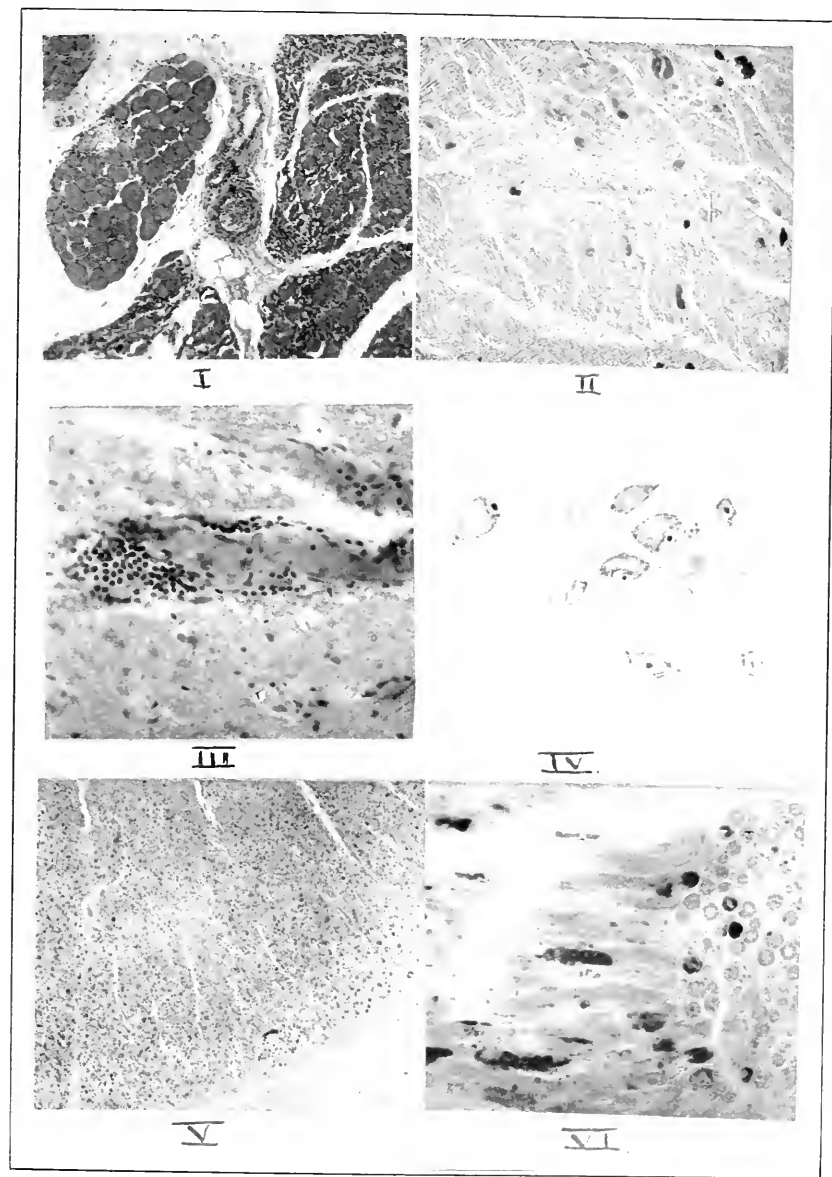


FIG. 1. Section of left psoas muscle. FIG. 2. Marchi preparation from same. FIG. 3. Perivascular infiltration. FIG. 4. Group of cells from anterior horn. FIG. 5. Marchi preparation from lateral column of cord. FIG. 6. Marchi preparation from peripheral nerve.



fissure, though a few were scattered throughout the pia-arachnoid. Similar collections of lymphocytes occurred inside the cord and these were mostly about the vessels in the white matter where the anterior roots emerged (Fig. 3), and about the vessels in the anterior horn region, though, in a given field, where one or two vessels were involved, the other vessels would probably appear normal. This perivascular lymphocytosis also occurred occasionally in the posterior horns, but then only around large vessels. Like those of the meninges, the lymphocytes of the cord were most frequent in the cervical region and grew gradually less as one descended the cord, until, in the lumbar and sacral regions, they again gradually increased in number.

The number of vessels inside the cord appeared increased and this more markedly in the lateral columns than elsewhere and more markedly in the left lateral column than in the right. There was no evidence of endothelial swelling, even with marked perivascular infiltration, except in a very few instances where the endothelial cells projected into the lumen of the blood vessels. There was also well-marked gliosis in the white matter of the cord and this was seen more in the degenerated parts of the cord (to be described later) than elsewhere, and more on the left side than the right. Many of the glia cells showed distinct protoplasmic processes. An increase of glia fibers was seen also in places about the blood vessels. There was no increase of the sub-pial glia ring of the cord.

With the Van Gieson method, changes in the white matter of the cord were most pronounced in the lateral columns. Ballooned fibers with much thinned-out myelin sheaths were very common. Many axis cylinders appeared swollen to several times their normal size and many were wholly absent. Except in the lower thoracic and upper lumbar regions the posterior columns appeared normal with the low power. With the high power, numbers of distended myelin sheaths with swollen or absent axis cylinders were observed in other parts. The diseased fibers were more or less in patches, but did not seem to have any special relation to the vessels. The posterior roots showed only a few dilated myelin sheaths, but in the anterior roots they were common. A section from the seventh and eighth thoracic regions showed in the right posterior column a definite area with marked increase of neuroglia and an unusual degeneration of the myelin sheaths.

The spinal ganglia showed no lymphocytosis, but several ganglion cells were in various stages of degeneration. Some of the capsules were thickened, with increased nuclei. Several cells showed deep-staining uniform masses inside the cell in addition to the nucleus and nucleolus.

Throughout the cord the anterior and lateral horn cells as well as the cells of Clarke's column were much fewer on the left side than on the right, but at all points both horns showed a marked diminution in the total of ganglion cells, and those that remained showed a high degree of degeneration. At all points the anterior and postero-mesial groups were most involved and the intermedio-lateral group least involved, and in the latter the largest number of

normal cells was seen. Here also one found most often quite normal cells in the midst of a group greatly degenerated.

The large cell counts at three levels are given below:

Sixth Cervical Segment			
Left			Right
4 cells	Antero-mesial group		5 cells
4 cells	Postero-mesial group		7 cells
12 cells	Intermedio-lateral group		19 cells
2 cells	Clarke's column		6 cells
First Lumbar Segment			
None	Antero-mesial group		3 cells
2 cells	Postero-mesial group		1 cell
None	Intermedio-lateral group		6 cells
None	Clarke's column		5 cells
First Sacral Segment			
None	Antero-mesial group		None
1 cell	Antero-lateral group		11 cells
None	Postero-lateral group		6 cells

In the second thoracic segment the right intermedio-lateral group contained twenty-eight medium-sized or large cells, and the left side only one. At the ninth thoracic the left column of Clarke contained one cell and the right thirteen cells, of which latter several showed vacuolization.

A few normal large anterior horn cells were seen at various points and occasionally a normal-appearing cell was to be found in the midst of others badly degenerated, but most of the anterior horn cells were either absent or distinctly diseased. The common change was a swelling of the cell (Fig. 4), and a lessening of or complete loss of its processes, so that it came to have a more or less globular appearance. The nucleus was peripheral or lacking. The center of the cell was pale or clear and the Nissl bodies were seen only as a thin line at the periphery as in the axonal reaction. Rarely cells were seen with the body filled with diffusely stainable material, more like the acute alteration and quite different from most of the cells. Many cells were seen only as a vague outline. Distinct vacuoles appeared in a few cells, especially in some areas. In certain cells, the tigroid bodies had unusually clear outlines. This latter did not appear to be merely a stage in the process of degeneration for many cells in different stages of degeneration did not show it. In some sections scarcely a single large ganglion cell, either diseased or normal, could be seen. On the other hand, in a section from the third sacral segment the cells in the different groups were almost normal in number and only a few showed a tendency to a pale center.

In the posterior horns, one saw from time to time cells of considerable size with a quite normal appearance and, in general, the cells of the posterior horns tended to be healthy, but a few were not so, and cells with distinct central pallor occurred.

A moderate number of corpora amylacea was seen in all sections.

Pigment was found generally in the ganglion cells of the cord in increased amount considering the age of the patient.

*Marchi Preparation of the Cord.*—At all levels of the cord numerous black granules appeared, but these were more abundant in the cervical and thoracic than in the lumbar and sacral regions. Thus at the fifth cervical segment the granules were abundant in the anterior and lateral regions of the cord and were about equal on the two sides. In the posterior columns they were much less abundant and were limited mostly to the periphery and more abundant in the right side than in the left. Compound granule cells and the golden-brown spindle-shaped pigment masses of the pia-arachnoid were both seen in very small numbers. Some of the black masses were merely the periphery of ballooned myelin sheaths. Others were large, diffuse-staining, black masses with no special relation to a nerve fiber, and still others were very fine granules. Sections from the seventh cervical to the second thoracic segments, inclusive, were much like the area described above, except that the number of granules was steadily increasing on approaching lower levels of the cord. At the fourth thoracic segment there was a fair number of fine granules at the posterior margin. More internal in the posterior columns and especially along the sides of the posterior horns was a greater number of much larger granules, more on the right side than on the left. These granules were abundant throughout the lateral columns (Fig. 5), gradually decreasing as one reached the anterior portion of the cord, though all other portions of the anterior columns were much more involved than the posterior columns. Some posterior roots that appeared in this fourth thoracic section showed definite Marchi reaction in certain bundles. At the seventh thoracic segment the entire cord showed black granules, but more marked in certain places than in others. Thus the right side was more involved than the left at all points. Also the posterior columns were fairly free except for a band of moderate width along the posterior horns, a few granules at the posterior margins and another still smaller group close to the posterior commissure. The right lateral region and both anterior regions contained a large number of granules; large, medium or small, with a fair number of large, irregular-shaped black or gray masses. Some anterior roots in this section showed changes much like those of the posterior roots at the fifth thoracic level, only more pronounced. At the second lumbar level there was a distinct increase of the golden-brown pigment of the pia-arachnoid. The granules in the white matter were much less abundant than above. There was a distinct group of black granules in either crossed pyramidal tract, but especially in the right. In the posterior columns the granules were largely limited to the extreme outer margin and to the extreme lateral region. A section from the second sacral segment showed many anterior and posterior roots. In the posterior roots there was a moderate number of Marchi staining fibers, and these were scattered about equally through the posterior roots. In the anterior roots certain bundles of fibers showed marked changes, and others very little. In the white matter the number of granules was still further reduced, though diffuse.

Section of a series of nerve fibers—sciatic, popliteal and radial, showed no evidence of acute inflammatory changes, but degenerative changes as revealed by the Marchi method were abundant. Large dark granules (Fig. 6) appeared at times with no evidence of myelin sheaths, and at all times the fibers of one bundle might be much more involved than those of its immediate neighbor. The large fibers were more involved than the small ones. The Weigert and Pal-Weigert sections of the peripheral nerves (Fig. 7) showed a similar irregularity of involvement of neighboring bundles of fibers.

*Weigert and Pal-Weigert Sections of the Cord.*—Nothing of consequence was seen in the meninges except a few scattered pigment masses. At all points the posterior root fibers (Fig. 8) appeared normal, while the anterior root fibers were shrunk and in many places only a few anterior root myelinated fibers (Fig. 9) could be seen. At all points the loss of large fibers seemed out of proportion to that of the small fibers. The anterior horns were smaller than normal, and this shrinkage was greater on the left side, which also showed fewer cells, than on the right.

There was a loss of myelinated fibers in the anterior horns, which were distinctly paler than the region of Clarke's column. This pallor was especially pronounced in the left anterior horns as compared with the right in the upper sacral region. In the cervical region the posterior columns appeared about normal. Beginning in the middle thoracic region a pale streak was seen with the unaided eye on the left side toward the lateral and central parts of Burdach's column. In the eighth thoracic segment, for example, the right posterior column was about normal, but the pallor in the left side was much increased as compared with fields higher up, and was still limited largely to a small area. At the second lumbar segment the lesion in the left posterior column had widened perceptibly, and there was a slight change in the opposite posterior column. A microscopic examination of the affected posterior area showed much fewer myelin sheaths than normal and many ballooned fibers with vague irregular outlines within. At the fifth sacral segment the posterior column showed no change.

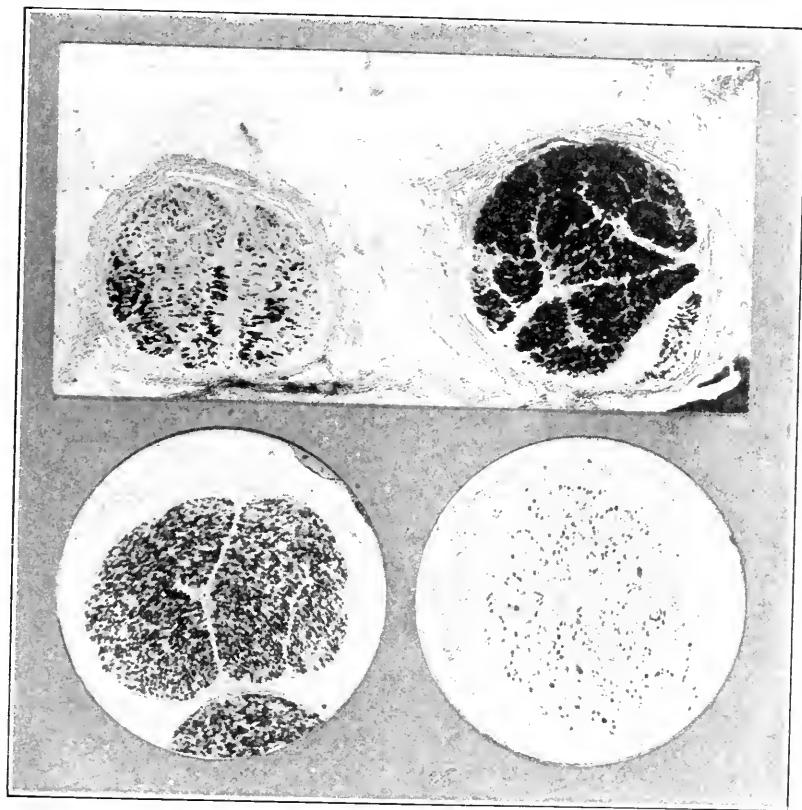
At all levels of the cord there was a pronounced atrophy of the white matter of the anterior and lateral columns, more marked at the margin than at points nearer the gray matter, and in the right direct and left crossed pyramidal tract than in the corresponding area on the other side. In the cervical region the left crossed pyramidal tract appeared about as pale as its fellow, but in the lower thoracic region the left side was much more affected. At the second lumbar segment the left anterior horn and the left Clarke's column were paler and more shrunk and showed fewer cells than on the opposite side. At the fourth sacral segment the degeneration, not great in either, was about equal in the two crossed pyramidal tracts.

Unfortunately the medulla was not available for study.

*Cortex.*—General histology: In most of the sections the pia-arachnoid was normal, but in a few and especially in the frontal



region there was some cellular infiltration. These areas also always showed a very slight perivascular lymphocytic cell increase. At all points the cortical stratification was normal. The individual nerve cells mostly stained well, with normal nuclei and nucleoli. Satellitosis was rarely seen. There was no increase of glia cells in the superficial layer or elsewhere and no vascular changes were seen except that the endothelial cells of the vessels at the margin of the



FIGS. 7, 8, 9, 10. FIG. 7. Above. Weigert preparation from peripheral nerves. FIG. 8. Weigert preparation of posterior root bundle. FIG. 9. Weigert preparation of anterior root bundle.

cortex were somewhat swollen. Many of the nerve cells had diffuse masses of pigment, out of proportion to the age of the patient, and the Marchi stain confirmed this. The fat granules were either at one end or scattered diffusely through the cell. The large cells showed more of the pigment than the small ones.

Passing over such cases as those of Von Leyden,<sup>1</sup> Möbius<sup>2</sup> and Eichorst,<sup>3</sup> as almost certainly not true atrophies, and those of

Etienne<sup>11</sup> and Fuchs<sup>13</sup> as of doubtful familial character, we have but few left to which the title familial progressive muscular atrophy in adults might properly be applied, and even in these the very important test of the post-mortem examination is almost wholly lacking. Accepting, however, the cases of Strümpell,<sup>4</sup> Gowers,<sup>5</sup> Osler,<sup>6</sup> Zimmerlin,<sup>7</sup> Hammond,<sup>8</sup> Bernhardt,<sup>9</sup> Bruining,<sup>12</sup> Dana<sup>14</sup> and Taylor<sup>15</sup> as belonging to this classification, we find much diversity as to clinical type. In the cases of Strümpell,<sup>4</sup> Zimmerlin,<sup>7</sup> one of Hammond's<sup>8</sup> cases, and three of Dana's,<sup>4</sup> the trouble began in the upper extremity. In Bernhardt's<sup>9</sup> case, the atrophy began in the neck and shoulders; in one of Bruining's<sup>12</sup> cases (II) in the neck, and in Taylor's<sup>15</sup> case in the third, ninth and tenth cranial nerves. In Osler's<sup>6</sup> case, two of Hammond's<sup>8</sup> cases, one of Bruining's<sup>12</sup> cases (I), one of Dana's<sup>14</sup> cases and in my own, the trouble began in the thigh or buttocks. Even in the same family the area involved in different individuals is not necessarily the same, contrary to Jendrasik's<sup>22</sup> statement of the absolute similarity of the phenomena in different members of the same family affected with a familial nervous disease. Thus, in Hammond's<sup>8</sup> cases, the atrophy began in the thigh in the father and son, but in the daughter it is said to have begun in the left arm and shoulder. In Bruining's<sup>12</sup> father and son, the trouble began in the thigh in the former and in the neck in the latter. In Dana's<sup>14</sup> family, three had their primary involvement in the fingers or arms, and two in the lower extremities. In my family the trouble began in the throat in the maternal grandmother and in the thigh in two aunts and in the patient specially studied. There is also a decided difference in the age of onset in the different families and in different members of the same family, to say nothing of the great differences that could be introduced if we eliminated the word "adult" from the title and admitted familial atrophies of childhood. In Strümpell's<sup>4</sup> case, the atrophy began at twenty-nine years; in Osler's<sup>6</sup> family at from less than twenty to fifty-nine years; in Hammond's<sup>8</sup> father and son at the same age, thirty-nine years, and in a relative "when young"; in Bruining's<sup>12</sup> father and son at forty-five and twenty-three respectively; in Taylor's<sup>15</sup> family when past fifty years and in my family in four members at fifty-five, forty, forty-three and thirty years respectively. The well-recognized factor of anticipation in familial disease may explain some of these differences as is seen in Bruining's<sup>12</sup> family.

Pain was present in one of Hammond's<sup>8</sup> cases, one of Bruining's<sup>12</sup> cases, two of Zimmerlin's<sup>7</sup> cases and in my case. Hammond's<sup>8</sup>

<sup>22</sup> Jendrasik, quoted from V. Rad. *Neurolog. Centralb.*, Vol. 31, No. 4, February 15, 1912.

patient had painful cramps. Other disturbance of sensibility has been limited to Osler's<sup>6</sup> case, where there was some loss of sensation, and to Zimmerlin's<sup>7</sup> case (I) where there was paresthesia in the legs, later disappearing.

The duration of the illness has varied from a few months to several years. Fibrillary tremor has been frequent, but not universal and was absent, for example, in most of Zimmerlin's<sup>7</sup> cases and in Dana's<sup>14</sup> case.

If one makes a distinction between chronic anterior poliomyelitis and progressive muscular atrophy it is difficult to determine in which class my case belongs. The clear hereditary element at once suggests progressive muscular atrophy, but in many respects the symptoms are much like those usually looked upon as pointing to chronic anterior poliomyelitis. Thus the rather rapid course of the disease in all four individuals (five months to one year), the beginning of the disease in the thighs in at least three cases and its spread in a peripheral direction, the relative degree of asymmetry in the two sides of the body at any one time, the presence of a considerable degree of pain without diminution of sensibility, and finally the pathological findings, constitute a very strong likeness to many cases such as Bruining's<sup>12</sup> which have been described under the heading chronic anterior poliomyelitis. Yet the point of onset of atrophy, for example, cannot be relied upon to exclude the case from progressive muscular atrophy, for we have the well-known Werdnig-Hoffman type of atrophy, in which the paralysis begins in the buttocks and thighs. Moreover if we follow closely a differentiation based on the location of the earliest atrophy observed, we should have to place under different headings members of the same family group, as is seen in Bruining's,<sup>12</sup> Hammond's,<sup>8</sup> and Dana's<sup>14</sup> cases, as well as my own. Bruining<sup>12</sup> lays stress on the progress of the disease from center to periphery in his cases as an evidence of chronic anterior poliomyelitis, but this cannot be given much weight in my case, for though the atrophy began in the thigh and spread to the leg, it certainly had reached a well-recognized stage in the hand before it appeared in the arm. In a general way, atrophy and paralysis went *pari passu* in my case, yet the patient himself had felt weakness in the left thigh before he observed atrophy, and it was certain that subsequently muscles were found where the weakness was out of all proportion to the atrophy. If the strong hereditary element in my case suggests dystrophy, the clinical signs do not point in that direction, and the pathological findings exclude such a diagnosis.

The diagnosis of an hereditary type of neural atrophy is perhaps less readily disposed of, but the lack of objective and also of subjective sensory phenomena, except pain, argue against such a disease, and the pathological findings are hardly compatible with the generally accepted changes referable to neural atrophy, though the histological changes found in the cord cells correspond very closely with those described by Meyer<sup>23</sup> under the term central neuritis.

As already stated, only a very limited post-mortem study has been done in cases which can fairly be described as familial progressive muscular atrophy in adults, and in the list given here only Bruining's<sup>12</sup> is available. With this case my own shows some similarity pathologically. In Bruining's<sup>12</sup> patient there was atrophy of the anterior roots and intact posterior roots. The anterior horns were shrunk and their ganglion cells and myelinated fibers were greatly decreased, and more so on one side than the other. There was diffuse shrinkage in the posterior and lateral columns. Clarke's column and the posterior horns were normal. There was no infiltration.

If we take up the cases described under chronic anterior poliomyelitis, however, and under this heading Bruining<sup>12</sup> classifies his cases, there are several instances on record where the findings have been much like those in my own case, as can be seen in Spiller's<sup>24</sup> excellent summary in the article on "Chronic Anterior Poliomyelitis" by Moleen<sup>24</sup> and himself. Thus Moleen<sup>24</sup> and Spiller in their case of chronic anterior poliomyelitis found the ganglion cells of the anterior horns largely absent, but those remaining mostly normal. There were some hemorrhages in the anterior and posterior horns of the cord and in the medulla and to a slight degree in the pons and cerebral peduncles, and even in the white matter of the cord, where it was adjacent to the gray matter. There was very slight direct and crossed pyramidal degeneration and no perivascular infiltration. Bielschowsky<sup>25</sup> found considerable atrophy of the ganglion cells of the anterior horns, the glia tissue increased and the blood-vessel walls badly diseased, with a round-cell infiltration in the neighborhood of some of them. At several points there were large and small hemorrhages in the anterior horns. The posterior horns showed vessel changes, but not much degeneration otherwise. The anterior roots were considerably degenerated. There was a slight change in the crossed pyramidal tracts. Darkschewitsch's<sup>26</sup> patient had dimi-

<sup>23</sup> Meyer. *Brain*, Vol. XXIV, 1901, p. 47.

<sup>24</sup> Moleen and Spiller. *Am. Journ. Med. Sci., N. S.*, 130, 1905, p. 1025.

<sup>25</sup> Bielschowsky. *Zeitschr. f. klin. Med.*, 1899, Bd. XXXVII, p. 1.

<sup>26</sup> Darkschewitsch. *Neurolog. Centralb.*, 1892, Bd. XI, p. 221.

nution in the number of ganglion cells of the anterior horns, numerous hemorrhages and rarefaction of the lateral and posterior columns. Oppenheim<sup>27</sup> found degeneration of Burdach's columns as well as degeneration of the ganglion cells of the anterior horns. Nonne<sup>28</sup> found marked degeneration of the ganglion cells of the anterior horns and rarefaction of the anterior and posterior columns. Grunow<sup>29</sup> reported the ganglion cells of the anterior horns much degenerated, small hemorrhages in the gray matter of the cord, cell infiltration about the arteries of the anterior fissure and about some of the vessels in the anterior horns and the white matter, and a degeneration of the anterior and lateral columns.

Lövegren<sup>30</sup> in a very careful study of a case of chronic anterior poliomyelitis reported the following findings: Extreme atrophy of the ganglion cells of the anterior horns, varying at different levels and greater in the right than the left. The cells had for the most part lost size, form and structure. The nucleus was peripheral or lacking, the tigroid substance was more or less disintegrated, especially in the center of the cells, and the processes were for the most part lost. Along with these abnormal cells, others were found with quite normal appearance. The atrophy extended over the entire anterior horns, but in the upper cervical region it was greatest in the anterior part of the anterior horns and in the lower cervical region the atrophy was greatest in the postero-external part. Clarke's cells were mostly normal, as were also the solitary cells of the posterior horns. There was considerable rarefaction of the nerve-fiber reticulum of the anterior horns, and a few fresh hemorrhages in the posterior horns. The anterior horn roots and peripheral nerves were shrunken. The posterior roots were normal. The cortex showed nothing of special consequence unless it be the amount of pigment in the cells.

Among these pathological reports those of Bruining,<sup>12</sup> Spiller,<sup>24</sup> Grunow<sup>29</sup> and Lövegren<sup>30</sup> seem especially like my own. In my case Clarke's column was almost as badly affected as the cells of the anterior horns and certainly as badly affected as the right antero-lateral group of cells. This involvement of Clarke's column has not usually been described either in chronic anterior poliomyelitis or progressive muscular atrophy, but in consideration of the varying location and degree of cell atrophy in the different cases, it can hardly be looked on as a vital matter.

<sup>27</sup> Oppenheim. *Archiv. f. Psychiatrie*, 1892, Bd. XXIV, p. 822.

<sup>28</sup> Nonne. *Deutsch. Zeitschr. f. Nervenheilk.*, 1891, Bd. I, p. 136.

<sup>29</sup> Grunow. *Deutsch. Zeitschr. f. Nervenheilk.*, 1901, Bd. XX, p. 333.

<sup>30</sup> Lövegren. *Sonder-Abdruck a. d. Jahrbuch f. Kinderheilk. S. Kargen*, Berlin, Vol. XI, 1905.

I have explained the occurrence of pain by the infiltration found in the meninges and posterior roots, and it is worthy of note that in Grunow's<sup>29</sup> case, where pain was well marked, this infiltration was specially observed. It seems not unreasonable to assume that where pain or other sensory trouble has not been observed, this infiltration has been lacking.

It has been stated by some authors that the degeneration observed in the white matter of the cord in progressive muscular atrophy or chronic anterior poliomyelitis is to be explained by the death of fibers connected with the diseased anterior horn cells, but the fact that the degeneration observed in the white matter has not necessarily corresponded with the degree of involvement of the anterior horn cells seems sufficient to dispose of this explanation, to say nothing of the fact that tracts of fibers, in other cases as well as my own, not associated with these cells, have been found greatly diseased.

Most authors make a distinction between chronic anterior poliomyelitis and progressive muscular atrophy, though many admit that this differentiation is by no means clear, and one can hardly accept any other conclusion after a summary of the literature bearing on this subject. It seems more in keeping with the continual reporting of new, but only slightly varying types of muscular atrophy, to accept the view specially emphasized by Jendrassik, Kollarits and Bertolotti, that in these cases we are dealing with a unified process in the nervous system, whose varying symptoms are determined solely by the extent of the lesion. At least it must be accepted that in addition to the more frequently met and clearly described types of muscular atrophy there exist other groups less frequently observed and which serve only as intermediary forms connecting the better-known types.

## NEW YORK NEUROLOGICAL SOCIETY

THREE HUNDRED AND SIXTY-THIRD MEETING, MARCH 5, 1918

The Second Vice-President, DR. WALTER TIMME, in the Chair.

### I. A CASE WITH SYMPTOMS REFERABLE TO A LESION IN THE PONS AND UPPER PORTION OF THE MEDULLA

Dr. Israel Strauss presented this case and gave a brief summary of the history and physical findings. The patient was a man forty years of age, married and with children. The Wassermann of his blood and cerebrospinal fluid was negative and there was no increase of cells in the latter and no globulin. His occupation was that of peddler and he was well until August, 1917, when he began to notice a staggering in his gait. One fact that was brought out, although the patient did not voluntarily contribute the information, was that for two years he had been getting hard of hearing; did not notice it very much for some time, but it had grown progressively worse during the last two years. He did not complain of headache until recently, but now complained of an uncomfortable feeling in his head, a peculiar feeling which was localized in the right frontal region. There was no history of vomiting and no tinnitus. He was admitted to the service of Dr. Sachs in August, 1917. Examination revealed complete anesthesia of the right side of the face, anesthesia of the cornea and a slight degree of hypesthesia on the right side of the body. The latter was later ruled out as subsequent repeated examinations failed to coincide. He had hypalgesia and hypesthesia on the left side of the body from the clavicle to Poupart's ligament. He showed also a weakness in the musculature of the right half of the body, but the power of the grasp now was fairly good. There was some weakness in the motor power of the right leg now and some slight facial weakness. At this time the paresis was definitely shown by the wideness of the right palpebral fissure.

The examination of the eyes in August showed negative fundi and there was no change at present. He had a paresis of the right external rectus which was present now. He also had a very marked lateral nystagmus and had it still in both directions but more marked to the right; he now had a well-developed up and down nystagmus. There was no atrophy of the tongue, but there was definite atrophy of the right masseter muscle. It could be noticed that the sternocleidomastoid on the right was fairly well marked, but on the left it did not stand out as markedly, showing that there was some atrophy present.

A change had taken place in this man's condition since his admission to the hospital last August. The complete anesthesia in the trigeminal region had disappeared and there was left a hypalgesia which was definite. He complained now of a queer feeling in the distribution of the superior branch of the fifth nerve. The larynx showed nothing. The gait was unsteady; he dropped the right foot, staggered somewhat when walking, but less so when walking slowly.

He now did the finger-to-nose test with some facility, but in the beginning had done it with more difficulty. The movement was still clumsy. He did it more easily with the left hand; slowly with the right. There was spontaneous by pointing to the left in the right arm. He was almost, if not completely, deaf in the right ear. The caloric test revealed that there was no impulse coming through the vestibular nerve. The reflexes on the right were exaggerated. There was a tendency to clonus on the right. A Babinski was present, though not very distinct, on the right and at times the reaction almost occurred on the left.

The diagnosis of this condition had been puzzled over a great deal; here was loss of vestibular impulse in the right ear; complete anesthesia of the right face showing involvement of the fifth nerve; atrophy of the right masseter showing affect of the motor nucleus of that nerve; weakness of the right side of the body; a change in the reflexes; loss of muscle power and dropping of the leg and interference with cerebellar impulses shown by the staggering gait and by pointing. Finally, he had one other symptom, the beginning atrophy of the left sternocleidomastoid.

The question of a neoplasm in the ponto-facial angle was considered. These were, of course, of slow growth. But these patients almost invariably have tinnitus and this man never did. If they progress so far as to cause complete anesthesia of the fifth nerve and affect the peduncles of the cerebellum, they should give other symptoms. Furthermore, a tumor of that type would continue to exert pressure upon structures in the neighborhood and one would not expect a lessening of the anesthesia of the fifth nerve such as had taken place here. Then too one could not explain in such a case the marked involvement of the sternocleidomastoid on the opposite side. Altogether, it seemed that this possibility might be excluded.

Was there a lesion in the brain stem itself? One thing pointing toward that was the type of nystagmus, the up-and-down nystagmus, the transmutation of impulses as shown by the demonstration of the caloric test. There was spontaneous nystagmus looking to the right. The vertical semicircular canals when stimulated did not send impulses through; the horizontal did, but it was a transmitted nystagmus. That form of up-and-down nystagmus obtained by caloric irrigation seemed to be almost always due to a lesion in the pons or upper portion of the



medulla. Why there had been a lessening in sensory distribution was puzzling, unless the original anesthesia was not due so much to the neoplasm there as to hemorrhage in the neighborhood of the neoplasm and absorption had occurred. It might be the glioma there was not exerting the same influence on that nucleus. It did not seem to be a vessel condition per se, the posterior inferior cerebellar artery, because there would be greater regression than there was here. The man himself felt no better; the gait had not improved and he was beginning to complain of paresthesia, which indicated that the process was growing.

Dr. Isidore Friesner spoke of the peculiar phenomenon to be demonstrated in this case, the transmutation of nystagmic impulses which he had observed first in cerebellopontine angle tumor. He had never seen it except where there was pressure on the pons. In this case, there was no headache and there were no fundus changes; nevertheless he believed this phenomenon occurred only where there was much pressure on the brain stem. This case illustrated also that the impulses which had to do with vertigo and those which aroused nystagmus were independent of each other. There was no definite relationship between past pointing and the direction of the nystagmus because this man, as the result of caloric stimulation of one external canal, got vertical nystagmus upward, yet his sense of being turned was normal and his past pointing was normal.

Dr. Joseph Byrne declared that he could not subscribe to this theory of transmutation of vestibular impulses; it was opposed to everything that was known of the physiological mechanism of the conduction and insulation of nerve impulses. A principle somewhat similar to that of transmutation was invoked by Head in his attempt to explain the mechanism of reflected pain. But all such suppositions were extremely unphysiological. A good deal of speculation had crept into the literature and spoken opinions regarding the function of the posterior longitudinal bundle. In Dr. Strauss's case, the vertical nystagmus observed after aural irrigation was capable of explanation without postulating any such phenomenon as transmutation of nerve impulses, or the equally unsubstantiated assumption that lesion of the posterior longitudinal bundle was the *sine qua non* of vertical nystagmus. In the speaker's own work, done some years ago, along these lines, he was readily able to produce at will vertical nystagmus by the use of bilateral aural irrigations in cases in which there was no question of involvement of the posterior longitudinal fasciculus.

Dr. Strauss regarded Dr. Byrne's objections as discounted by his own statement that he had not made these tests for a long time. The speaker was doing it all the time both on animals and on patients and was very sure of his results.

## II. IS THE PINEAL BODY A GLAND OR A VESTIGE?

Dr. Frederick Tilney gave a résumé of the result of a comprehensive study of the epiphysis, conducted with a view to settling the mooted question whether the organ is the rudiments of an eye which is found in some of the lower vertebrates, or a functional one. The problem of the pineal body had been approached from three angles: (1) the morphology and evolutionary significance, (2) the physiology and pathology and (3) the clinical aspect. The present address dealt only with the morphology and evolutionary significance.

A tremendous amount of literature had been found to exist regarding the epiphysis going back to the earliest times of medicine. Descartes gravely considered it the seat of the soul. Voltaire used a delicious bit of metaphor in speaking of it as a piece of gray matter acting as driver and controlling the action of the cerebral hemispheres by means of two nerve bands, which were long referred to by anatomists as "the reins of the soul." Majendie called attention to its position, arguing from this as well as from its structure and form that its function was to serve as a tampon regulating the flow of the fluid of the ventricles from the third chamber to the fourth. Coming down to the last fifty years, during this time the pineal body had been almost universally considered a vestige of the parietal eye and this had also been the opinion of the speaker before the evidence to the contrary had been accumulated and analyzed.

The present discussion was divided under five principal heads: (1) the significance of the pineal region in its relation to the epiphysis; (2) reasons against the pineal body being a vestige and in favor of its being an organ necessary to metabolism in some way; (3) histological evidence of function from its structure; (4) relation of the pineal body to the parietal eye; and (5) phylogenetic significance of the parietal eye with reference to the vertebrates and invertebrates.

Lantern slides were thrown on the screen showing that the pineal region is preponderatingly glandiferous in its derivatives. It followed, therefore, that the morphogenetic impulse imparted by such a gland forming area could not fail to have a profound influence upon the epiphysis.

That the pineal body could not be a vestige was shown by the evidence based upon its gross morphology. This evidence was presented first in the phyletic constancy of the epiphysis in the vertebrate phylum. One hundred and ninety specimens were studied of cyclostomes, selachians, ganoids, teleosts, dipnoi, amphibia, reptilia, birds and mammals, and in all of these there were only one or two in which there was not direct evidence of the presence of a pineal body. Its constant occurrence in cyclostomes, in all the fish, in amphibia and reptiles, in birds and mammals revealed it as a structure which must have been called into being in response to some definite demand.

The second point lay in the variations and morphologic specializations which presented themselves in this organ in the various orders of vertebrates, indicating its appearance in the interest of definite adaptations.

The third point was the relatively greater phyletic constancy of the epiphysis with reference to other structures in the pineal region, for it alone presented this constancy.

The fourth point was the gross evidence of the progressive specialization of the pineal body in ophidians, birds and mammals.

The fifth point was the increase in the epiphysocerebral index from the earliest stages to the latest periods of life in man. The epiphysis kept constant pace from early to late age with the hypophysis which was, it was well known, an endocrinic organ.

The sixth point was the resistance that had been shown by this organ to the encroachment of that prominent neomorph, the corpus callosum, in the mammalian brain and which had produced marked alterations in the other constituents of the diencephalic roof plate.

The histological evidence also showed that the pineal body could not be considered a vestige since the tendency toward specialization was definitely in the interest of glandular formation in ophidians, chelonians, birds and mammals. Ontogenetically, in two forms at least, the cat and man, the development of the pineal body followed the general lines of glandular differentiation. The pineal body was, therefore, a glandular structure and as such was necessary in some way to metabolism.

The histology of the organ gave clear evidence that the epiphyseal complex of vertebrates possessed a pluripotentiality whose fundamental inherent tendency was in the interest of glandular differentiation, but in a few instances, as in cyclostomes, amphibia and primitive reptiles, the pineal organ might become further differentiated in the interest of a highly specialized sensory mechanism which has, or has had, visual function. As a gland it might in some cases contribute its secretion to the cerebrospinal fluid, but in the higher vertebrates it was an endocrinic organ.

Dr. Tilney then discussed the theory that the pineal body was a vestige of the parietal eye. He had arrived at the conclusion that there was no direct relation between them; his theory was that each in itself was an adaptive modification answering the demands for, or representing an inherent impulse toward the development of a parietal eye on the one hand, or a glandular organ on the other. The pineal body as it appeared in mammals could not be regarded as the vestigial or metamorphosed, degenerated or atrophic residuum of the parietal eye in lower forms of vertebrates, for by far the greater majority of vertebrates manifested in the epiphyseal complex, as well as in the region from which it springs, no tendency whatever toward the development of any neural mechanism. There was entire absence of all remnants indicative of visual specialization: universal absence of true

ganglionic cells as well as the lack of nerve fibers. The differentiation which occurred in the higher reptiles, birds and mammals gave rise to glandular tissue.

The phylogenetic significance of the parietal eye in vertebrates as the homologue of the median eye in invertebrates should be accepted with much reservation. Until the time when the homology between the vertebrate pineal region and some corresponding area of the invertebrate brain was much more firmly established than at present, the parietal eye as an index in the evolution of the vertebrates from the invertebrates had but little value.

Dr. Tilney closed his address with the statement that although he had begun this research with the firm belief that the pineal organ was a vestige, he had been forced to the conclusion on the strength of his findings that it was without question in mammal and man an important endocrinic gland contributing the products of its secretion to the blood stream and functioning in the interests of bodily metabolism.

Dr. Joseph Byrne felt he was voicing the sentiment of all present in expressing his deep appreciation of Dr. Tilney's clear presentation of the results of his remarkably able study. The pineal body had been the subject of discussion for ages; it had even been exploited by religious sects. It would certainly seem now that the glandular hypothesis was the most substantial one in the face of this unquestionable proof of its verity.

### III. EARLY SURGICAL AND ORTHOPEDIC TREATMENT OF HEMIPLEGIA

Dr. Joseph Byrne read this paper, the result of a combined study by Dr. Alfred S. Taylor, Dr. Samuel W. Boorstein and himself. Before doing so, he presented several cases showing the results of the treatment. The first was a man aged 39 years who was thrown from a street car on June 1, 1916. He was picked up unconscious and later had right hemiplegia with motor aphasia. Operation was performed by Dr. Alfred S. Taylor, who operated on all the cases in this series, and a large extradural clot, amounting to ten ounces, was evacuated. One year after his accident he had twelve convulsions lasting ten minutes. After that his recovery was uneventful and to-day he was fully restored to health. The next case also illustrated extradural hemorrhage causing hemiplegia. A boy of fifteen was knocked down by a coasting sled. At first he was unconscious and after a lucid interval again became unconscious and developed convulsions which began as twitchings in the left hand and arm, although the external marks of injury were on the left side. Fundus examination showed that the intracranial compression was also greater on the left side. At operation nothing was found on the right side, but on opening the left side of the skull an extradural clot was found. Death ensued shortly after the second operation.

A third case, a child, was injured somewhat like the last. He was thrown from a sled and picked up unconscious. He had a fracture of the right side of the skull and in the period of lucidity exhibited hemiparesis of the face and hand on the left side. Although he did not show marked pressure signs operation was decided upon. A subdural clot was found with contusion of the brain. He made a satisfactory recovery.

The next case, a man 55 years of age, was an illustration of intracerebral lesion causing hemiplegia. In March, 1916, he suffered an apoplectic stroke and his condition was serious, although there were no signs of increased intracranial pressure. The clinical diagnosis was thrombosis. Five weeks after onset, there being no signs of improvement, it was decided to operate. Decompression was done and a needle passed into the descending horn of the ventricle showed no increased intraventricular tension. Shortly after operation Dr. Boorstein instituted orthopedic treatment; in two weeks he had on a plaster cast and inside of another week he was walking. Another case of intracerebral lesion causing hemiplegia occurred in a woman of 58 years with a high blood pressure and kidney disease. She had a stroke which was followed by left hemiplegia with phenomena characteristic of the thalamic syndrome. Operation helped her considerably. The fluid in the ventricular system was under great tension. A small clot and some bloody serum were evacuated from the vicinity of the internal capsule and the ventrolateral aspect of the thalamus.

The next case, a woman 48 years old, had an apoplectic stroke twenty months ago during an attack of pneumonia and came to the hospital asking operative relief for left hemiplegia. The skull was opened on the right side and a cyst was found covering the lower portion of the Rolandic area. After operation there was great relaxation in the spastic muscles but the contractures of the hand and foot began to return after two weeks and Dr. Boorstein put on a plaster cast.

The next patient had been at a home for incurables for twenty-one years unable to walk because of marked deformity, the foot, being in marked flexion and the knee flexed at right angles. He was operated on the received orthopedic treatment for two years and now he was able to walk.

The last case, a young colored girl, was hit on the head by the lid of an icebox in July, 1916, but not rendered unconscious. Soon afterward she commenced to have headaches. In October, 1916, while eating an apple she felt something snap in the left jaw and her face began to feel peculiar; the feeling extended to the hand and leg. The case was at first diagnosed as poliomyelitis and later on as hemiplegia. In January, 1917, operation was performed and later she was treated orthopedically with good results. The gross movements of the limbs were free and effective, though the fine movements were still impaired. At operation Dr. Taylor went as far as the internal capsule and finding

unusual resistance to the needle he introduced an illuminated endoscope whereby the lesion in the internal capsule was actually seen.

Hemiplegia was the immediate result of suspension of function in the upper motor system of neurones. The usual cause was some serious interference with the circulation through hemorrhage, embolism or thrombosis. The mechanism consisted of (1) direct lesion; severance or changes in the paths consequent on impaired blood flow, contusion, laceration, necrosis, softening, etc., (2) indirect lesion; compression of the paths as the result of blood clot, edema, etc., and (3) a combination of the two causes. Pressure upon the cortex from hemorrhage, extra or intradural, sufficient to cause hemiplegia usually terminated in death if unrelieved. The mechanism here was an obstruction of the capillary circulation in the medulla with consequent strangulation of the vasomotor and respiratory centers.

The main problem in the cases under consideration, from the point of view of early surgical interference, was the relief of intracranial pressure that menaced life or hampered restoration of function. In such cases as those in which traumatic extradural hemorrhage was the cause, operation was imperative before the end of the third stage (manifest compression). In other conditions, such as those found in intradural hemorrhage, either traumatic or spontaneous, the greatest care should be taken to study the effects of the increased intracranial pressure and the capacity of the brain and cord to make compensatory adjustments. The pulse rate, blood pressure and eye grounds should be systematically studied from hour to hour, or even more frequently, to determine how the medullary centers withstood the strain. Above all the behavior of the respiratory mechanism should be carefully watched; this had been carefully observed in this study for some time, clinically and experimentally, as an index of increased intracranial pressure. In experiments on animals, the sequence of events usually observed was as follows: fall in blood pressure, enhanced respiratory movements, rise in blood pressure, apnea, fall in blood pressure, and so on. A very significant index of disturbed medullary circulation was that modification of the respiratory movements which consisted mainly in a relatively prolonged and more or less accentuated expiratory phase. This type of breathing was very different from the normal and wherever it was present it gave cause for concern. This altered ratio of inspiration and expiration might be accompanied by mild phasic periods suggestive of beginning or modified Cheyne-Stokes respiration.

From the moment the medullary mechanisms have unmistakable indication of being unable to cope with increased intracranial pressure, surgical intervention was to be regarded as a conservative measure, in lesions which in addition to causing hemiplegia also threatened life. Operative interference was also indicated in lesions which, because of marked focal pressure, might cause permanent paralysis or deformity. Such lesions were mainly of the intracerebral type, those most suitable

for operation occurring in the vicinity of the internal capsule where a very small lesion so readily caused hemiplegia.

Extradural lesions were often limited practically to hemorrhage from the middle meningeal artery; in its typical course the clinical picture showed a primary period of unconsciousness followed by return of consciousness which was again succeeded by unconsciousness, these phenomena being accompanied by signs of progressively increasing intracranial pressure which might lead to paralysis of a limb or hemiplegia.

In intradural lesions of traumatic origin hemorrhage was usually venous, but the resulting edema of repair of contusions as well as the incidence of secondary arterial hemorrhage might call for operative interference, though as a rule operative interference was contraindicated in intradural hemorrhage. Nevertheless resulting intracranial conditions, such as general pressure, focal pressure, the possibility of cystic formation and growth, etc., might outweigh all other considerations. Spontaneous intradural hemorrhage was usually of arterial origin and where it was large enough to cause hemiplegia it usually destroyed life if the intracranial pressure was not relieved by prompt surgical measures.

Intracerebral hemorrhage of spontaneous origin resulted from arterial degeneration, arteriosclerosis, endarteritis, tumors (gliosarcomata), etc. The great majority of these hemorrhages occurred in the vicinity of the internal capsule as the result of rupture of the so-called lenticulostriate artery, an even when small they might cause marked and widespread sensory and motor disturbances due in part to direct lesion of the nerve paths and in part to focal pressure. These possibilities suggested surgical intervention at once as a means of preventing deformity or disability. Removal of the small clot and of the collection of serum surrounding it was often readily effected by the mere passage of a moderate-sized needle through the brain substance. This relieved focal pressure and prevented degeneration of tissue as well as cystic formation, both of which contributed so largely to the extent and permanency of disability.

The result of this study and experimentation might be summarized as follows: Early operation any time within two to four weeks, or even longer, might be indicated in hemiplegia: (1) where the intracranial pressure threatened medullary strangulation, no matter what the site or nature of the lesion might be; (2) in extradural hemorrhage, with or without intradural hemorrhage, in cerebral contusion, where cerebral compression threatened life or permanent disability; (3) in intradural hemorrhage of traumatic or spontaneous origin where cerebral compression threatened life or permanent disability; and (4) in intracerebral hemorrhage where focal compression threatened permanent disability.

Dr. Alfred S. Taylor explained that the object of presenting these cases was to stimulate interest in the early treatment of hemiplegia.

In the old man who was aphasic an ordinary left subtemporal operation was done and it was found that the apex of the temporal lobe and the portion of the brain including the speech center was softened and flabby and what looked like melted butter came out through the exploring needle. The improvement following indicated that some change in the local circulation occurred in the brain which stimulated recovery. The belief before operation was that there had been a ruptured blood vessel, but after finding the actual condition of the brain substance it was decided that it must have been a thrombosis followed by softening.

The last case, the colored girl, was the most interesting of the series. There was extreme spasticity of the left arm and hand and left foot. Even with passive motion one could hardly get the arm and hand completely extended. On decompression the cortex looked normal, but in putting in an exploratory needle a little over one centimeter marked resistance could be felt. Pushing in a little further a small amount of fluid came out through the needle; it was denser than ventricular fluid and slightly yellowish in color. On pushing the needle still further the ventricle was entered and some normal ventricular fluid came out. It seemed possible that an endoscope through which there was illumination might give some information about this deep lesion, so one was inserted into the tissue which gave resistance, the light turned on and perfectly white avascular tissue was seen. On withdrawing the endoscope the line of demarcation was visible between the avascular tissue and normally pink brain substance, so it was felt that there was some form of cicatricial change involving the capsule which accounted for the marked spasticity.

The woman presented who was operated on a few days ago had marked spasticity and a large cyst of the brain was found. Running up from the cyst which was at the angle of the fissure of Rolando and the horizontal limb of the fissure of Sylvius was an area of softened brain tissue, fluctuating and easily compressible; it ran upward and backward practically to the midline keeping just posterior to the post-Rolandic convolution. After the operation the spasticity disappeared for six or seven days and then reappeared.

Another case was a woman who died. She was the first case at Fordham and was interesting and suggestive. She was a woman of fifty who had been visiting relatives in the Bronx and was about to return home when, standing at the top of some stone steps, she fell and was picked up unconscious. After a week's observation she was sent to the hospital with a diagnosis of fracture of the skull with epidural clot. She was still unconscious and there was low muttering delirium, high blood pressure and casts in the urine. Radiogram showed no fracture. As she was unconscious no anesthetic was necessary. A subtemporal exploratory operation was done. There was no damage to bone, but the dura was tense; there was no pulsation. On opening the dura one could feel underneath the cortex of brain an indurated



mass into which a grooved director was passed and a clot about the size of an English walnut and some bloody serum were extruded. In twenty minutes the woman was conscious and could answer questions. Unfortunately at the end of two weeks uremia gradually caused her to sink and she died three weeks after operation.

The principal point was this; if one could get results from patients with hemiplegia a long standing by a subtemporal decompression, this operation seemed desirable in fresh hemiplegia. It would save them a great deal if one were to do a subtemporal decompression and evacuate the clot, for otherwise there was destruction of a certain amount of brain tissue and there was also danger of damage from pressure. It seemed logical that decompression with evacuation of the clot would give all the recovery that could be gotten in hemiplegia and ten times as rapidly as by waiting for the clot to absorb. This work was not original. A case was reported in 1911 by a railroad surgeon in Pittsburgh who operated on a railroad conductor who after several months showed no evidence of ever having had trouble with the central nervous system. Hudson reported eight or ten cases. It had, therefore, seemed desirable to present the question of the treatment of hemiplegia primarily by evacuation of the clot and secondarily by some form of orthopedic treatment for discussion this evening.

Dr. Samuel W. Boorstein discussed the subject from the orthopedic standpoint. Carefully conducted experiments had shown that the deformities and contractures of hemiplegia could be prevented. Even in old and neglected hemiplegics great improvement could be obtained. A patient with hemiplegia should be put in the same category as poliomyelitis and receive proper orthopedic treatment from the beginning. The treatment should be instituted at the same time when the operation on the skull was done, or usually a few days after the operation. Plaster splints should be applied immediately to prevent contractures. After an attack of apoplexy the distal segments of the limbs, the feet and hands were affected more often than those near the trunk. At the onset of the attack there was sometimes a temporary initial rigidity of the muscles of the paralyzed side, or an early rigidity might develop in one or two days. At about the second week there was always a late rigidity, slight at first but gradually increasing until finally contractures affected the paralyzed limbs, unless preventive measures were taken and there was a vital necessity for realizing that such measures should be taken. Plaster casts could be used or splints with elastic bands. The comfort of the patient might be augmented by the use of a brace with a drop ring to bend the knee when wanted and allowing its extension on walking. Plaster casts for the knee, however, gave the patient a certain security and thus encouraged early walking. These temporary splints could be left on without disturbance until one was anxious to begin massage treatment. If plaster had been used, it could be cut into halves and removed for massage and exercise, or braces could be applied, if they had not been used from the beginning.

Massage and exercise formed a very important part in the treatment of affected limbs. Massage could usually be begun about two or three weeks after onset. In regard to exercise it seemed advisable to lay emphasis on the following points: (1) Specific exercises should be ordered for each case; (2) the case must be thoroughly studied to know to what extent the nerves and muscles were affected; (3) exact details of the exercise should be laid down by the physician, the muscles to be exercised, the character of the exercises and the number of times the particular movements should be performed at each session as well as the number of sessions each day. Symmetrical exercises were advisable, *i. e.*, where the sound limb performed at the same time the same motions the affected limb was supposed to make. Frankel's book on *Tabes* demonstrated how to teach these patients the proper way of walking, sitting down and getting up. Exercise was very necessary as an adjunct to the cure of these cases; it avoided the effects of general idleness, it improved the paralyzed muscles, it prevented arthritis of the joints so common in these cases, it lowered blood pressure and it stimulated endocrine secretions. Electricity also was of value, but it should not be forgotten that electricity indiscriminately used was capable of increasing the hypertonus one was trying to combat.

Dr. William M. Leszynsky asked Dr. Taylor if his treatment referred to cases of acute apoplexy where the patient might be unconscious for twenty-four hours and then spontaneously recover.

Dr. Alfred S. Taylor replied that he meant just such cases.

Dr. William M. Leszynsky admitted that no one with experience would seriously question the views expressed in regard to early operative intervention in patients with hemiplegia resulting from epidural, subdural or cortical hemorrhage due to head injury. Surgical procedure in such conditions had been successfully practiced for many years.

The condition, however, in the acute stage of hemiplegia from cerebral apoplexy caused by hemorrhage, thrombosis or embolism, presented an entirely different proposition. In such comatose patients it was not always possible to decide whether the hemiplegia was due to hemorrhage or thrombosis. The views expressed by the speakers recommending subtemporal decompression and the passage of a trocar into the neighborhood of the internal capsule in such cases should not pass unchallenged. If such a surgical measure was to be undertaken, it could be justified only in very rare instances of unmistakable capsular or intraventricular hemorrhage, as it was well known that in many patients who survived, the coma disappeared spontaneously, the damage to the fiber tracts having taken place at the time of the onset of the attack.

Dr. I. Strauss considered that all were agreed that in traumatic cases the time for operation was the time when intracranial pressure was evident. Only the day before a child had been brought to Mt. Sinai

after being struck by an automobile, in shock, unconscious and with hemorrhage from the ears indicating fracture of the base and with symptoms of fracture of the vault. Dr. Charles A. Elsberg decided to wait until there were symptoms of intracranial pressure before operation. This morning the child was conscious and showing no evidence of paralysis, pulse of 104 and comfortable. This was a case where operation performed at the time of injury would not have assisted in the recovery.

The other class of cases which Dr. Byrne showed, those in which hemiplegia had taken place from apoplectic conditions, presented the question, would surgery overcome the condition produced by hemorrhage in the brain as it did for hemorrhage of internal organs elsewhere, or should one wait a certain length of time to see how much spontaneous recovery of function took place? The question to decide was whether operation should be done at once. Surgically speaking, it would seem that given a hemorrhage anywhere the proper thing to do was to remove the clot which was jeopardizing any important organ. But if surgical procedure at this time would jeopardize the life of the patient, but might give results that might or possibly might not be accomplished by nature, the question could not be solved except by the experience of a number of years and with a large number of cases. In the early stages patients sometimes died from apoplexy not due to hemorrhage or destruction of tissue by itself but from intracranial pressure; in such a case one would feel inclined to at least relieve the pressure if not to remove the clot. In those cases where restoration did not occur three or four months after an attack of apoplexy, should surgery then interfere? In the cases shown this evening in whom there was complete hemiplegia lasting for months, Dr. Taylor achieved marvellous results by passing an endoscope through the internal capsule. There was one case in which certainly decided improvement followed operative intervention. The method of recovery was not clear because nothing was removed. Absorption may have been the cause or a cyst may have been evacuated which had formed by the degeneration of the clot.

Dr. Alfred S. Taylor thought that the discussion had gotten astray. There was no question about traumatic cases; the main fact was the question of operative intervention early in cases of apoplexy. The argument against that intervention appeared to be that the danger of operation should not be added to the pathological condition of the patient. In order to discuss the question logically one must determine how much danger existed. The operation itself was a comparatively slight one; no anesthetic was needed, for the patient being unconscious one did not add the danger of general anesthesia. The operation of subtemporal decompression was a slight one; there was little blood-letting and no shock. A piece of bone two by three inches was removed and the rest of the operation consisted of cutting the dura and, if the

clot was left within the brain, slipping in a grooved director at the site of the clot and the blood would extrude itself. The whole thing was of little menace to the patient. It had been done several times by the speaker. It should be emphasized that there was no shock attached and the operation itself was not dangerous, so that for anyone to say that one should not add the "danger of operation" magnified that consideration on the wrong side of the column. If a clot the size of an English walnut had formed in the brain, the best thing to do was to remove the clot and nature would have a better chance to bring about restoration. In a fair number of cases there will be much greater improvement than by tentative treatment and it is worth while to give them the benefit of the doubt. Those who were going to die would only go a few moments sooner, and those who were going to get well anyway after absorption would recover ten times as quickly and much more completely.

Dr. Joseph Byrne, in closing the discussion, said that the subject had been treated in a conservative way as regarded operation. There was nothing very radical in what was undertaken. The cases were studied most carefully and only after long thought and careful judgment was operation decided upon and this was always done conservatively. Dr. Leszynsky raised the question of thrombosis, but the speaker believed that even thrombosis might be helped by operation.

The actual mechanism by means of which nutritive interchange between the nervous tissues and the blood was effected was not yet fully known. Dr. Sabin had shown that true lymphatics were not present in the central nervous system. Perivascular spaces existed through which probably in part the cerebrospinal fluid reached the nerve tissues proper, for nowhere else did tissue of mesoblastic origin, *e. g.*, the blood, come into direct contact with neural tissue which was of epiblastic origin. It was readily understood that in thrombosis or embolism the areas of necrosis in the region of the obstructed vessel might be benefited by any procedure which diminished or altered focal pressure conditions and therefore favored the establishment of collateral capillary or perivascular circulation. Finally, one must consider the possibility of cystic formation and the pressure which might be generated by the activity of secreting cells throwing their output into a tightly sealed cavity.

# THE INTERNAL SECRETIONS AND THE NERVOUS SYSTEM<sup>1</sup>

BY M. LAIGNEL-LAVASTINE

Authorized Translation by Fielding T. Robeson, M.D.

*(Concluded from page 74)*

## (3) HYSTERIA

Hysteria, whatever the idea may be that one holds in regard to it,<sup>136</sup> is observed among "the nervous."

I have shown the frequency of neuroses of endocrinal origin. I believe that I can class the disorders of internal secretion among the predisposing causes of hysteria through the intermediary of nervosity. As a matter of fact I have often found endocrinal disturbances, especially of the thyroidal or ovarian type, among hysterics.

## (4) PSYCHASTHENIA<sup>137</sup>

Etymologically psychasthenics should be classed among the neurasthenics in whom the asthenia bears especially on the psychic sphere.

But following along with Raymond and Janet we class especially as psychasthenics those who, on the whole, are obsessed.

When one follows these cases one sees that their paroxysmal blustering syndromes are nothing but the morbid offshoots of deeper variations of nervous tonus or psychic tone. These changes in women are nearly always connected with the sexual life. In man one finds them running parallel with such symptoms as headache, insomnia, hyper- or hypotension, tachycardia and constipation, which frequently can be connected with endocrinal disorders.

Thus among the predisposed, obsessions, which might be regarded as a mental autonomic syndrome, are often nothing but the psychic expression of a more or less diffuse anxiety which in itself is the result of a disturbance of the sympathetic system of endocrinal origin. Thyroidal excitation particularly, by increasing the

<sup>136</sup> Laignel-Lavastine, *Les réactions anti-sociales des hystériques*, Paris Médical, 30 mai, 1914.

<sup>137</sup> Schnyder, L., *R. méd. de Suisse romande*, oct., 1913; Lubetzki, S., *R. de méd.*, août, 1913.

irritability of the peripheral sympathetic centers which it controls, predisposes to these dissociations of personality. The thyroid, so to speak, is an anarchistic emancipator.

Be that as it may, the variations in nervous and psychic tone thus determined may react secondarily on all the vegetative functions not forgetting the ductless glands, and can thus establish a vicious circle.

### (5) EPILEPSY

It is always wise in the diagnosis of an epilepsy after becoming advised as to the causes explaining the cortical changes to pass in review the reasons for the organic poisoning and among these not to overlook the glandular disturbances. The search for the minute signs of these disturbances may thus institute the use of one glandular therapy rather than another. It is most often the thyroidal disturbances that are revealed in endocrinal disorders among epileptics.

Many subsequent works<sup>138</sup> have confirmed this conclusion in my report of 1908.

Sometimes they are hypothyroideal in type and sometimes dyshyperthyroideal. This is not contradictory. The endocrinal disorder, according to the statement of Léopold Lévi, "is the pathological mordant that sensitizes centers already predisposed." The endocrinolepsy,<sup>139</sup> whatever form the crisis may take, is set free by a complete rupture of the endocrinal equilibrium. The incidental causes alone are different. Thus in a still unpublished lecture<sup>140</sup> on the thyroid body and epilepsy pertaining to a confusional epileptic stupor seen in a tuberculous heredo-alcoholic Basedovion, I showed that the crisis coincided with and followed her menstrual periods, while with her hypothyroidal sister they preceded them as a rule, and were absent during pregnancy.

In the epileptic seizures of thyroidal origin, therefore, I wish to differentiate the dyshypothyroideal crises from the dyshyperthy-

<sup>138</sup> Sicard, *Journ. de med. de Paris*, 1912; Gelma, *Rev. de med.*, 10 janv., 1913, pp. 26-39. Guilton, *Contrib. à l'ét des symp. épileptiques dans les états thyroïdiens*, Th., Montpellier, 1913, No. 58; Enzière et Margarot, *Soc. de sc. méd. de Montpellier*, 2 mai, 1913; Silvestri, *Opothérapie surréno-médull. et épilepsie*, II Policlínico, 20 juin, 1913, pp. 917-922; Dufour et Legros, *Syndrome hypo-ovarien et hypo-thyroidien. Crises épileptiformes (vagotonie)*, *Soc. méd. des hôp.*, 27 mars, 1914; Bolten G., *Monatsch. f. Psych. u. Neurol.*, 33, No. 2, fév., 1913; Claude et Schmiegeld, *Encéph.*, 10 janv., 1909.

<sup>139</sup> Léopold Lévi, *Les endocrinolepsies*, *Soc. de méd. de Paris*, 9 janv., 1914, p. 41.

<sup>140</sup> Laignel-Lavastine, *Clinique psychiatrique*, 22 mars, 1914.

roidal<sup>141</sup> crises; these latter discharges moreover possibly surviving in all three forms of thyroidal instability.

#### 4. TEMPERAMENTS

Temperament, as I said at Dijon in 1908, is the dynamic characteristic of the organism, just as constitution is the static characteristic. Following this conception of Professors Bouchard, Landouzy and Roger it can be stated that what one is to physiology the other is to anatomy. Now it appears to me that among the various functions, the individual varieties of which have to do with temperaments, those of the internal secretions should not be neglected, and when one decides to take up the long-forsaken study of temperaments in accordance with the classical types—the sanguinary, the nervous, the lymphatic and the bilious, one might discern perhaps the thyroidal, the pituitary, the adrenal, the ovarian and diasthematic, etc.

This view of the question is but the application to the internal secretions in relation to temperament, of the masterly conception of Prof. Charles Richet expressed at the Congress of Vienna in 1910: "We are as yet but at the portal of that chemistry of the imponderable, founded on the analysis of biological functions, and although we can already foresee some of the results, we are soon led into a region in the study of the physiology of the individual, which until to-day was almost unexplored," that physiology which, in my lecture at the opening of the course on medico-legal psychiatry in 1910, I called the differential physiology, and I linked differential psychology with the knowledge of character and differential anatomy with the knowledge of constitution.

Since then the idea has been greatly amplified, and Prof. N. Pendé<sup>142</sup> has allotted a chapter to it in his remarkable report of 1912 on the internal secretions. As a clever clinician he has related the constitutional vascular hypotonia of Ferrannini with the thymolymphatic state of Paltauf or the asthenic or hypoplastic constitutional state characterized by hypoplasia of chromaffin and genital tissue combined with hyperplasia of lymphatic and thymic tissue.

<sup>141</sup> Ces crises me paraissent vraiment rythmées par les règles quoi qu'en disent Toulouse et Marchand (*R. de Psychiatrie*, mai, 1913).

<sup>142</sup> Rapin, Angioneuroses familiales, *R. med. de la Suisse romande*, 1907, p. 196.—G. Maranon, *R. de med.*, mars, 1914, p. 180.—Falta, loc. cit., p. 39.—Léopold Lévi, Familles thyroïdiennes et dysendocriennes.

<sup>143</sup> N. Pendé, Le secrezioni interne nei rapporti con la clinica XXII<sup>e</sup> Congresso di Medicina Interna in Roma, oct., 1912.

Then again he believes that he can connect the vagotonia of Eppinger and Hess with the exudative diathesis of Czerny.

He considers the lymphatic and thymo-lymphatic states to which he adjoins the chlorotic state as an organic immaturity of the endocrinal system in its chromaffin and genital parts contrasting with excessive development in the same system of its lymphatic and thymic parts. He recalls the antithesis established by Viola between the apoplectic or short or megalosplanchnic habitus with the phthisical or long or microsplanchnic habitus. He adds that very frequently hypothyroïdeïa coincides with the megalosplanchnic habitus and hyperthyroïdeïa with the microsplanchnic. Remarking also that he has often seen signs of vagotonia among the megalosplanchnics and of sympathicotonia among microsplanchnics he deducts this double equation: vagotonia-megalosplanchnia-hypothyroïdeïa; sympathicotonia-microsplanchnia-hyperthyroïdeïa.

Pendé very prudently does not advance these considerations except as a means of indicating the road to follow, and in fact this classification seems to me to err through too great a desire for symmetry and by too static a conception of the notions regarding vagotonia and sympathicotonia.

These predominances as a rule only express the evolutionary moments of the individual. Thus when asleep at night we are all vagotonics. The adult and the aged differ more from the child than the sleeping man from the awakened. Their vegetative nervous formula has therefore the chance of not remaining the same all during life.

If I criticize the too sharply drawn lines of the theoretical elucidation I share, as I have already said, in the directing idea. It is moreover essentially French. Léopold Lévi and H. de Rothschild have been the first to deserve the credit for connecting the classical neuro-arthritic diathesis with hyperthyroidism.<sup>144</sup> It is true that prior to that time Hertoghe classed adenoid cases as among the hypothyroidal, and opened the way for the classification of many lymphatic temperaments among cases of hypothyroidism.

Another step along the trail brings us to the diatheses of Bazin—a masterly conception and a very true one, which the fancies of the pastoral era had caused to be forgotten, but to which we bring back the analysis of temperament in the light of endocrinology.

Finally I must recall that Lancereaux, when he saw in the sympathetic the principal factor in herpetism, had in advance the

<sup>144</sup> Léopold Lévi, *Neuro-arthritisme et gl. endocrines*, Mouv. méd., mai, 1913



intuition of the ties which unite endocrino-sympathetic disturbances with temperaments.

To-day I believe it possible to enlarge and clarify the question a little, thanks to what I have called, in a clinical lecture, the endocrino-diagnosis of temperaments: an endocrino-diagnosis which must be worked out according to the method of glandular tests of Claude and his pupils, and which will allow one to depict a series of types. This series of types will depend on thyroidal or ovarian or testicular or pituitary or suprarenal temperaments more or less clearly defined, according to the more or less marked predominance of one or of several of the glands of internal secretion in the endocrinal equilibrium. I expect to publish in the near future a description along these lines of the principal temperaments.

### 5. CHARACTER<sup>145</sup>

Character, to my mind, as I said in 1908, is nothing but the psychological expression of temperament. Constitution, temperament, character are thus but three expressions—anatomical, physiological and psychological—of the reactional coefficient of the individual.

"The importance of individual varieties of internal secretions will be seen again therefore in characters. The laity have long spoken of good or bad humor in their spontaneous psychology and also of humor in medical parlance. This identity of terminology seems to me to conceal a profound meaning, which the study of the internal secretions uncovers. These secretions by their variations react on the mental life as well as on the rest of the organism, and manifest themselves at first and above all by changes of humor, modifications of affective life, because the latter rather than motor or especially intellectual activity depends on organic life from which it can scarcely be separated.

For a long time my observations have done nothing but confirm me in my opinions. The choleric are such only through the thyroidal temperament, just as the lazy are such only through suprarenal hypoplasia.

Nevertheless, even if an endocrinal factor often enters into the formation of character, I do not claim that it always does so, and many other elements play a primordial rôle in such formation. In addition the law of constancy allows the establishment of relationships between morphological and psychological series which are

<sup>145</sup> Kollarits Jenő, *Charakter und Nervosität*, Budapest, 1912.



2. The two-fold critical analysis of the neurological and particularly the endocrinological methods of investigation permits, in the midst of the unknown, the redemption of certain definite relationships between the endocrinal and the nervous disorders.

3. Until more ample investigation it seems to me that these relationships might be expressed in the following table.

In practice the great aid that endocrinology brings to the study of neurology and especially functional neurology manifests itself particularly in the clinical study of

1. Ordinary symptoms, such as asthenia, headaches, insomnia, anxiety, sweats, constipation, arterial hypertension and obesity.
2. Endocrino-sympathetic syndromes, such as Basedow's syndrome, Addison's syndrome, scleroderma and diabetes mellitus.
3. Psycho-neuroses.
4. Temperaments.
5. Characters.

Endocrino-diagnosis of temperaments, particularly through glandular tests and sympathico-vago-tonic examinations, in penetrating the familial heredity, will allow us to use prophylactic measures in combating diatheses and in combating certain of the factors, the humoral and neuro-vegetative factors for instance, which are formative of character.

## Current Literature

### II. SENSORI-MOTOR NEUROLOGY

#### BRAIN AND MENINGES.

Baeslack, F. W., Bunce, A. H., Brunelle, G. C., Fleming, J. S., Klugh, G. E., McLean, E. H., Salomon, A. V. MENINGOCOCCAL CULTURES. [Journal A. M. A., March 9, 1918.]

The preliminary report of a study of the culture of the *Meningococcus intracellularis* at Camp Jackson, S. C. They say the nature of the onset and course of the disease in some cases suggested a sytemic infection before the meninges were involved. The course of the disease seemed to divide itself into two phases, the premeningeal and the meningeal, the first characterized by chills, severe toxemia and petechiæ. The spinal fluid taken at this time was frequently clear, free from polymorphonuclear leukocytes and the butyric acid test for globulins was either very faint or negative. Fehling's solution was reduced. That the meningococcus occasionally gets into the blood is shown by the occurrence of lesions in various parts of the body from which the meningococcus has been recovered and identified. These lesions have been generally regarded as late systemic manifestations of the disease, and the occurrence of the organism in the blood was considered exceptional. The early appearance of these lesions, however, in this epidemic made the authors believe that it was essentially a systemic infection, and led them to advise the early intravenous use of serum. An occasional blood culture taken in the course of the epidemic confirmed them in the belief that the organism, in the early stages of the disease, invades the blood. While the twenty-five cases of the series reported is a small total it is very suggestive. The meningococcus is a difficult organism to cultivate, even from the spinal cord, and a blood organism is highly parasitic. The percentage of positive cultures obtained point to a much higher incidence than the actual figures show. As large amounts of a vigorous growth have to be transferred, so a large amount of blood is necessary for the inoculation of the first culture, and in the milder cases the number of organisms, at best, is necessarily small; for this reason it is in the relatively severe cases, in which the number of organisms is large, that the positive culture is obtained. The fact that the organism has been isolated from lesions in which the meningococcus infection was not suspected, indicates the probability that, even in the milder cases, the disease is general rather than a local infection confined to the meninges. Up to the present the stress of work has made the taking of more than one culture from one individual exceptional, but at present

as soon as the provisional diagnosis has been made, and before the serum is administered, a culture is taken. The method of making cultures and subcultures is described in detail, with their appearance and growth. The following are the conclusions reached by the authors: "(1) Systemic infection by the meningococcus is more frequent than previously suspected. (2) This systemic infection may occur without appreciable or with no meningeal localization. (3) Systemic infection may be previous to, or coexistent with, meningeal involvement. (4) Consequently the intravenous administration of antimeningococcic serum is rational, and is indicated in conjunction with the intraspinal treatment." In taking the blood for cultures a sufficient amount was taken for agglutination tests, the results of which will be reported later.

**Silberschmidt.** SIGNIFICANCE OF CARRIERS IN CEREBROSPINAL MENINGITIS. [Correspondenz-Blatt für Schweizer Aerzte, February 16, 1918. Med Rec.]

Silberschmidt states that carriers occur alike among the sick, convalescent and recovered patient, the nurse and other bystanders, and finally among the unknown. In scarlet fever and poliomyelitis one is quite ignorant as to who bears the disease germ, because the latter has never been isolated. One may speak of permanent carriers who have never been infected, temporary carriers or eliminators who have recently suffered from the disease and permanent carriers who have gone through the disease but cannot throw off the germs. The significance of carriers and methods of elimination vary with the disease. In cerebrospinal meningitis the acute course and high mortality make a strong impression on the public. The epidemiologist is impressed in a different fashion. He notes that the earliest cases are deadly, but that the later are neither so acute nor so fatal. This is especially the case in barracks and among young adults. But in a community with many children things change greatly. As a rule an adult carrier infects a child. Thus in Silesia workmen from an infected district settled in a new community and communicated the disease to the children of their boarding masters. In France, reservists who had never been infected were sent home when the disease first appeared in the barracks and transmitted the disease to the children. We now know beyond doubt that the meningococcus is harbored in the nasopharynx. From 10 to 30 per cent. of carriers never became infected. It is also well known that a subject with the disease seldom appears to convey it to others. In children's hospitals, even when no precautions are taken, spread of disease from the infected is almost unknown. The young recruit, coming to camp among conditions strange to him, is exposed to the weather conditions which would ordinarily cause catarrh of the nasopharynx. The time of year—February to March—is the era of exposure and propagation of disease. It has been shown that when a certain number of carriers enter a barracks the number of cases bear no relation to the number

of carriers. The rounding up and interning of the latter seems to be an injustice, considering the very small number of cases which can be imputed to the presence of carriers. There is a marked factor of predisposition which explains the infrequency of infection in those directly exposed. As long as scores of carriers transmit little or no infection, the carrier problem in cerebrospinal meningitis becomes almost a dead letter. In diphtheria it is quite otherwise for here the carrier is justly accused of spreading the disease and is proportionately feared. Most physicians attach great importance to the bacteriological diagnosis, but cases occur in which laboratory and clinical finds do not correspond which cause a certain attitude of reservation. If in all such cases a second test were at once made the latter attitude would doubtless be changed. This refers to the initial diagnosis with especial reference to the indication for serotherapy. But in a case proved to be diphtheria no one attacks the great value of bacteriology because only through the laboratory can one determine whether a subject is cured and free from danger to others, and whether he still harbors germs and is a menace to others. But both the avirulent diphtheria bacillus and the pseudo diphtheritic bacillus constitute problems which can often only be solved by inoculation tests on guinea pigs. In clinical diphtheria there is no such germ as an avirulent Klebs-Loeffler bacillus, but the latter occurs at times in healthy men and those ill with maladies other than diphtheria, irrespective of past disease and epidemic incidence. If several hundred school children are examined at a given time a few may be found to harbor avirulent diphtheria bacilli. To what extent such children are potential carriers is unknown. They differ wholly in this respect from the healthy carriers of virulent germs discovered when the disease is prevalent and may be regarded as dangerous carriers. Neither local nor systematic treatment is certain of sterilizing a carrier and the only protection to give society is isolation, as in the case of the typhoid carrier.

**Gay, F. P. and Minaker, A. J.** MENINGOCOCCUS CARRIERS. [Journal A. M. A., Jan. 26, 1918.]

These authors say that, while it would probably be impossible to make any conclusive statement at present as to the degree of systemic reaction of healthy meningococcus carriers, there is evidence of the occurrence of aborted attacks of meningitis in carriers, which indicates an acquired immunity of some efficiency. It has been generally admitted and specifically proved that the usual tests for antibodies (agglutinins, fixation antibodies) yield no results of significance in positive meningococcus carriers. It seemed of interest, however, to the authors, especially in view of the results of the typhoidin test in cases of recovery from typhoid, to test the localized intracutaneous susceptibility to preparations of meningococcus in positive carriers, as compared with those who on similar examinations from the pharynx showed no sign of

meningococci. For several months the writers have tested the naval recruits at the station and positive carriers have been isolated until cultures from them became negative as the result of appropriate treatment. They do not claim that the separation between positive and negative carriers is definite on the basis of a single bacteriologic examination. They admit, therefore, that some of the so-called negative reactions occurred sometimes in persons harboring meningococci. They describe their method of preparing the meningococci used in these experiments as follows: "Pure cultures of five of the six strains chosen as representative of the meningococcus group by Amoss (Rockefeller strains numbered 1, 10, 30, 44 and 60, including two type meningococci, two irregulars, and one normal parameningococcus) were grown on 1 per cent. starch agar without peptone for forty-eight hours in ordinary slant tubes. These separate cultures were suspended in sterile saline solution, to each tube 3 c.c. The suspended cultures were mixed, and three volumes of absolute alcohol added. The organisms were flocculated at once and were rapidly centrifugalized, the supernatant fluid removed, and the bacterial deposition thoroughly shaken in the original volume of fresh absolute alcohol. Recentrifugalization, removal of alcohol, and resuspension in ether (distilled over sodium) were performed. After recentrifugalization and decantation, the sediment was dried two days in partial vacuum over sulphuric acid. The hard dried sediment was ground to impalpable powder in an agate mortar and dried again for twenty-four hours as before." This preparation was then suspended in physiologic salt solution containing 0.5 per cent. phenol. The dose employed in the intradermal tests is a volume of 0.05 c.c. containing 1 to 150 mg. of the dried meningococcus powder, care being taken to inject the dose so as to leave a persistent bleb under the superficial skin layers. Readings of the reaction were made at the six hour, twenty-eight hour and forty-eight hour periods. A positive reaction is seen in a well demarcated areola of from 3 to 7 mm. which is distinctly indurated. The most marked results are apparently at the twenty-four to twenty-eight hour period and the reaction has usually disappeared in forty-eight hours. The writers found this reaction positive between two and three times as frequently in the cases classified by bacteriologic examination as positive, when compared with those classified as negative. The average size of the indurated areola was 3.9 mm. in the negative cases, whereas in the positive it was 4.75 mm. There was also some evidence that the more persistent carriers would give the more intense reaction. The writers present these findings with reserve as to their full significance. It would seem certain that with more extended bacteriologic examinations, the relation between a positive intradermal test to the meningococcus and the presence of the meningococcus in the throat would become more evident. The duration of the localized infection would doubtless affect the results. The significance of this relation, if it proves usual, would be to indicate systemic reaction on the

part of the carriers and probably indicate some degree of acquired resistance. Whether the reaction would serve a diagnostic purpose in the detection of meningococcus carriers must only be suggested for further investigations.

**Laroche, G.** EPIDEMIC MENINGITIS. [Arch. d. Med. et d. Phar. Mil., June, 1917.]

Laroche discusses the introduction of antiserum directly into the lateral ventricle, reviewing the literature and reporting two successful cases of his own. His procedure, working with Ramond, is to trephine at a point 3 cm. below the median line and the same distance in front of the bregma. The needle is pushed in for 4 or 5 cm. with the tip directed toward the opposite ear. He does not hesitate to withdraw the needle and reinsert it in another direction if no fluid emerges, for he believes that successive punctures do no harm to the brain. If however the needle were worked about, there would be danger of injuring the white fibers. He uses a lumbar puncture needle with a stout guide, and suggests that the tip should be a blunt one which would push the arteriole out of the way rather than lacerate it. He selects a point where there are no large arteries and where there is no sinus. The amount of antiserum injected should not exceed two thirds of the amount of fluid withdrawn. He warns against sensitization toward the serum and utilizes a preliminary small injection by Besredka's technic. He recommends vaccination according to Ramond's method if antiserum precipitins are found in the cerebrospinal fluid. This consists of mixing in vitro 6 c.c. of the antimeningococcus serum with 3 c.c. of the tyndalized cerebrospinal fluid and injecting the whole subcutaneously two days before resuming the antiserum treatment. Sensitization may be avoided by early trephining puncture before this phenomenon can set in. Laroche thinks that this intraventricular serotherapy is best practiced upon children since the fontanel facilitates puncture. His own cases reported were however two young men, one of whom recovered.

**Fabbretti, A.** CEREBROSPINAL MENINGITIS. [Riv. Crit. d. Clin. Med., Mar. 2, 1918.]

This investigator gives his experiences with serotherapy in cerebrospinal meningitis with thirty-two cases at the hospital for infectious diseases at Florence. A third of these patients were over forty years old. He believes that the serum should be pushed vigorously during the first eight or ten days, before the anaphylactic state has time to develop. Otherwise there is the danger of anaphylaxis, which he considers the cause of the ill effects of serotherapy in certain cases. The graver toxic cases seem not to be benefited by the serum, but in the milder cases the disease is shortened and its severity lessened, while sequelae are warded off. [Experience in Camp Jackson, S. C., seems to show marked beneficial results from intravenous serum treatment in



severe cases. See Intravenous Serum Treatment of Epidemic Cerebrospinal Meningitis, W. W. Herrick, Arch. Int. Med., Apr., 1918.] After the first vigorous application in the early days of the disease, the serum should be given only in case of serious relapse with meningococci present in the cerebrospinal fluid. Serum should not be injected when the fluid is under high pressure. Serum sickness resulted in seven cases. In three cases where, a week or two after the last injection, another injection was given, there was a return of meningeal symptoms more intense than the original manifestation but quickly subsiding. One injection, the fifth in the case, given on the sixteenth day of treatment, caused collapse with cessation of respiration for a few seconds. Convulsions resulted in two cases after the third or fourth injection. One case of severe kidney disease received no injury from the treatment but instead the condition was improved under the accompanying dietetic measures. Only one of these patients manifested any marked sequelæ. These were a slight spastic paralysis and total blindness. The mortality was 41.3 per cent, but the age of a large proportion of the patients would account in part for this.

**Bezy, A.** EPIDEMIC MENINGITIS OF VARIOUS ORIGINS. [Arch. des Mal. d Enf., Dec. 17, 1917.]

Bezy comments on the unusual number of meningeal cases which have come to his attention the last year. There were twenty-six, when he had never before seen more than five in a year. He believes that the meningeal reaction should be considered only a part of the whole disease picture. Among his cases there were eleven of undoubted tuberculous meningitis. In ten cases the meningococcus was found, while in five no germs could be discovered.

**Herrick, W. W.** INTRAVENOUS SERUM TREATMENT OF EPIDEMIC CEREBROSPINAL MENINGITIS. [Archives Internal Medicine, April, 1918.]

This investigator bases his study of this epidemic upon the importance of recognizing a premeningitic stage of meningococcus sepsis, of which the meningitis is a secondary complication. Such has been the basis of the clinical experience which he reports from the Base Hospital at Camp Jackson upon 208 cases. Primary meningococcus sepsis was recognized in almost half of the cases before the meninges were characteristically involved. Besides, abortive cases and other atypical cases were recognized and intravenous serum has been established upon a sure basis with marked reduction of mortality and development of valuable methods of diagnosis both at the bedside and in the laboratory, in spite of the many disadvantages of an inadequately equipped hospital and an overworked staff. An unusual opportunity was however afforded for studying the disease in its earliest stages on account of military control, which brought about prompt report of symptoms.

The first stage of meningococcus sepsis lasts from a few hours to three days, usually forty-eight hours. Clinically the signs are low fever, slow pulse with vagal irregularities, characteristic attitude, manner and facies. The patient is resisting and wants to be let alone and resents especially exposure to cold. The intelligence is good but there is a remoteness of voice and expression. The temporal veins and those of the forehead are full, the eyeballs are tender and there is cyanosis of the face and in the margins of the ears. There is also often involvement in the upper respiratory tract. The skin shows predominantly a petechial rash, some cases sometimes a macular one, while in fulminating cases purpura appears. The reflexes are a most valuable diagnostic means in these early stages, the deep reflexes being unequally increased, while in other infectious diseases the increase is uniform on both sides of the body. There are often slight chills and headache is common and may be most severe.

At first the spinal fluid is usually clear with a slight increase in pressure, a normal number of cells, with or without a trace of globulin and it reduces Fehling's solution. One or more pairs of meningococci are usually found after careful examination. Repetition of lumbar puncture often brings down the organisms, which Herrick believes have been present in the cerebral-intraspinal spaces. The abortive types are mild systemic cases, many of them with symptoms and signs of meningeal irritation but they do not have the rash. The spinal fluid may be under increased pressure but contains generally no meningococci. Diagnosis can be made only on the clinical picture and the possible demonstration of the meningococcus in the spinal fluid, nasopharynx, conjunctivæ or blood stream. The cases quickly recover and their chief interest lies in their extreme epidemiologic importance. The atypical cases are reserved for a subsequent report. In the ordinary type the evidence of meningitis develops gradually upon the general symptoms already described. Unconsciousness is rare and the course may be prolonged. Headache, stiff neck, positive Kernig and Brudzinski signs, altered reflexes, irritability and the purulence of the spinal fluid are the marked signs. Hydrocephalus is a present danger. There is severe toxemia evident in the severe type with aggravation of the desire to be let alone and depression. The upper respiratory tract is frequently involved and there is also profound prostration, with unconsciousness before secondary suppuration has become evident. The chief feature is the startlingly rapid development of the petechial rash. Polyarthritides is a frequent complication, but death may intervene before any such complications appear. Intravenous serum treatment reveals in these cases its astonishing effect, rousing the patient from coma and in a short time reducing the other symptoms and quickly altering the prognosis. The fulminating cases develop rapidly with a severe toxemia and death may result very quickly with only mild premonitory symptoms. The temperature runs higher than in the other types, the pulse

is rapid, vomiting is present, delirium, the petechial rash, and most characteristically, extensive purpura. Blood culture or examination of the spinal fluid readily confirms the clinical evidence. Meningitis is usually not present. The complications in this disease point to the view of a general sepsis. Sometimes a general toxemia arises after the first symptoms disappear or there may be a nidus of infection from which a relapse arises. Panophthalmitis is a serious sequela in some cases and meningococci have been found present in the eye in large numbers. Other eye complications have arisen and there have been also cardiac complications. Pulmonary lesions are not uncommon and arthritis has been frequent. Otitis media has also followed, also epididymitis and orchitis, also some cases of monoplegia. In many of these complications meningococci have been found either in an obtainable exudate or at necropsy. Epidemic cerebrospinal meningitis may occur in conjunction with some other infection, for the meningococcus seems to flourish in soil prepared by anything that lowers the body tone. Necropsy revealed a remarkable dryness of bodily tissues, which accords with the extreme thirst of the patients. In several cases it was demonstrated that the exudate was subarachnoid and not immediately subdural. The treatment here described has aimed to reach the organism during the stage of systemic invasion rather than to attack a metastatic focus of infection in the meninges. Experience has seemed to justify the modification of the serum treatment, which formerly consisted of intraspinal therapy alone, then of intraspinal combined with timid intravenous injection. The present author has used a bold intravenous treatment with liberal drainage of the spinal fluid and the use of sometimes a considerable, unusually a small amount of serum intrathecally. No ill effects have appeared from the large intravenous doses, while small doses seem to have sometimes a harmful effect. The effort has been to sterilize the blood in the early stages by these large intravenous doses and then to follow by spinal drainage, and when meningitis is established, serum is introduced into the spine to relieve headache which may attend such drainage. Treatment must not be overdone and must also be supplemented by morphine especially in the early stages. Chloral and bromides may be of use to control symptoms. It is in the severe types that the most striking results are obtained by the intravenous therapy. Not only has it lessened the percentage of mortality by about one half in the cases treated, but it has also markedly reduced the number of complications, shortened the period of the disease and altered the clinical picture, obviating much of the usual distressing signs and creating instead an atmosphere of cheerfulness and optimism in the wards. Ventricular puncture did not seem justifiable. It is necessary sometimes to relax the muscles of the neck and even to manipulate the head to facilitate the flow of fluid into the spine.

**SPINAL CORD.**

**Head, H. and Fearnside, E. G.** CLINICAL RESEARCH AND THE PHYSIOLOGY OF THE SPINAL CORD. [Brain, 40, 1, 2, (Lancet)].

The war has given many opportunities of studying these results of gross injuries of the spinal cord and cauda equina, and this study has firmly established the physiological principles resulting from the clinical work of Hughlings Jackson, the morphological investigations of Gaskell, and the laboratory experiments of Sherrington, Langley, Anderson, and others of the Cambridge school of physiologists. To an exposition of certain of these phenomena the greater portion of the last number of Brain (Vol. XL, Parts 2 and 3), edited by Dr. Henry Head, is devoted. The number opens with a review of the innervation of bladder and urethra, by Dr. E. G. Fearnside, giving a retrospect of knowledge upon the involuntary nervous system and its relations with the lower portion of the spinal cord. Dr. Head and Captain G. Riddoch follow with a paper on the automatic bladder, excessive sweating, and some other reflex conditions, while in a third paper Captain Riddoch discusses the reflex functions of the completely divided cord in man and compares them with those of less severe lesions. All these authors agree with Sherrington that inhibition is one of the most fundamental and universally applicable of all physiological conceptions. In his masterly work on the integrative action of the nervous system Sherrington showed more than a decade ago that the basis for understanding the activities of the central nervous system must be sought in its integrating and adapting functions and the investigations now recorded by Head and Riddoch, and by Riddoch alone, serve to emphasize the importance of the mechanism which Sherrington has called postural in determining the type of response in a man whose spinal cord has been severely damaged. So long as this mechanism is intact, the impressions which constantly pass from the otic labyrinths and somatic muscles to the cerebellum, pons and mid-brain determine a state of tonic contraction in the group of anti-gravity muscles. When the damage is severe enough to destroy the postural mechanism the lower portion of the spinal cord is found to react to stimuli of whatever origin in a manner called mass-reflex by Head and Riddoch. Whenever the cord reacts in this massive manner three types of adaptive response only have been determined:

(a) *Protective*: A uniphasic withdrawal of paralyzed parts after "harmful" stimulation ("flexor spasms"). (b) *Excretory*: By this form of activity the contents of the bladder and rectum are discharged, whilst the skin over the parts supplied through sympathetic fibers derived from the freed portions of the spinal cord is excited to intense sweating. (c) *Sexual*: A primitive type of reaction which is excited to activity by stimulation of either the external organs of generation or of the paralyzed parts.

Whenever, on the other hand, the postural system can be proved to be still active, differentiation of somatic and visceral activities is found, the massive type of response ceases, and the phenomena of inhibition, as shown by a limitation in the range of efferent motor responses, make their appearance. The reactions obtained from the central nervous system are now di-phasic or multi-phasic, while somatic and visceral responses are separated. The receptive field for the flexion-reflex, for example, now no longer extends over the whole of the paralyzed regions. The clinical investigations recorded in these papers further go to prove that the thoracico-lumbar outflow of the sympathetic nerve fibers, which pass into the involuntary nervous system, regulate sweating and control the functional activity of the bladder, are at origin segmentally arranged; and that the arrangement is closely similar to, if not absolutely identical with, that which Gaskell, in 1886, showed to be true for lower mammalia. In their course these efferent fibers are closely associated with afferent fibers passing similarly from the viscera, blood vessels, and other parts supplied by the efferent fibers. As a part of the generalized "mass-reflex" in cases of severe injury to the spinal cord, excessive sweating takes place over areas of skin supplied by sympathetic nerve fibers originating below the level of the lesion. Even when the bladder is freed from all central nervous connexions and control, it may begin to expel its contents automatically as early as 25 days after the injury. The form assumed by the activity of such an automatic bladder is entirely independent of the site of the lesion in the spinal canal. In the absence of the postural mechanism automatic evacuation may be facilitated by the most various afferent impulses passing into the lower portion of the spinal cord, unless a cauda equina lesion prevents the impressions from reaching the cord. Through the afferent fibers associated with the sympathetic outflow, and reaching the bladder via the hypogastric nerves, a patient may be conscious of alterations of tension within his bladder and yet be totally unable to effect by conscious effort its automatic activity. The lesson is drawn that in cases of spinal lesion, whether due to injury or disease, it is essential to avoid exercising undue tension on the bladder wall when washing out the bladder; undue pressure diminishes the power of spontaneous evacuation and retards the recovery of the vesical musculature.

**Juarros, C.** UNILATERAL PARALYSIS AGITANS. [*Siglo Med.*, Dec. 8, 1917.]

Juarros finds confirmation for the ascribing of paralysis agitans to some cerebral lesion in the fact that the tremor is limited exactly to one side and that there is no sensation of heat or perspiration on that side. The tremor would seem to be an indication of abnormally exaggerated muscle tonus, which may be arrested by the inhibition produced by a voluntary movement during the period of the latter movement.

**Bristol, L. D.** COMPARATIVE STUDY OF INFANTILE PARALYSIS. [Jl. Med. Research, Jan., 1918.]

Bristol presents the epidemiology of poliomyelitis in the possible light of a widespread human pasteurellosis, in which the nonparalytic cases represent chiefly the digestive and respiratory types of the disease and the paralytic cases the nervous type. The disease may be spread in a manner analogous to that of pasteurellosis in animals, either directly by contact with the fresh secretions or excretions of an infected individual, a healthy carrier or one diseased, or indirectly by insect carriers, or perhaps in dust, and uncooked food or drink. The great variation in virulence of the various bipolar bacilli must be considered. Thus bipolar bacilli most virulent for one particular species of animal may cause similar symptoms in other species though not with the same virulence. In such cases it may be that sporadic cases, and small and local outbreaks, might have their origin in lower animal reservoirs, but that severe, widespread epidemics, and increasing prevalence of the disease are explained by a passage of the human strain of the organisms from person to person and with a steadily increasing virulence.

**Hoessly, H.** SEQUELÆ OF POLIOMYELITIS. [Correspbl. f. Schw. Aerz., Mar. 9, 1918.]

Hoessly reports a striking similarity in fifty-two patients under treatment for bilateral paralysis from poliomyelitis at the Zurich orthopedic institute. In each case the paralysis had affected the antagonists of the two feet so that one foot was in pronation and the other in supination. He believes that this is more than a mere coincident fact.

**Regan.** SKIN AND THROAT MANIFESTATIONS OF POLIOMYELITIS. [Archives of Pediatrics, Dec., 1917.]

Regan makes a detailed report of the throat involvement in poliomyelitis during the early acute stage of the disease. There is congestion of the faucial mucosa and the pharynx, while the soft palate assumes only a deep red without much congestion, and often, besides, a varying violaceous tinge, to some extent distinctive of poliomyelitis. The congestion of scarlatina, in the mucous membrane of the throat, is both more extensive and more intense than in acute anterior poliomyelitis. It is accompanied also by a punctiform rash on the soft palate and the throat is bright red in color. Rarely there is in poliomyelitis a macular rash on the buccal surface, sometimes resembling Koplik's spots. Otherwise the buccal mucosa shows only a slight change of color with only occasionally the marked congestion of the blood vessels seen in measles and scarlatina. Follicular exudation of the tonsils is very rare and true membrane formation has not been found, but there is usually a mild degree of inflammation. The gums are also inflamed occasionally and there is some epithelial coating upon them. The tongue is usually heavily coated, except at the edges and tip, with a grayish or yellowish white covering.

**Sanz, E. F.** INTRASPINAL TREATMENT OF SYPHILIS OF THE NERVOUS SYSTEM. [Siglo Med., Nov. 10, 1917.]

Sanz reports marked success in the treatment of tabes from the use of mercurialized or salvarsanized autoserum or spinal fluid. He regards this as the only promising treatment in tabes. He precedes this treatment with a course of mercury and salvarsan used intravenously and by extreme caution has avoided any ill effects. His results have been disappearance of the greater part of the subjective symptoms, correction to a greater or less extent of the incoördination, and improvement of the general condition. Even the knee jerk returned on both sides. There is a local reaction with pains in the lumbar region and limbs and other disagreeable sensations. The withdrawal of blood to supply the necessary serum is also disagreeable to tabetics. The cerebrospinal fluid does not seem to contain enough albumin to saturate the mercury. His procedure was to inject mercuric chlorid from 0.5 to 3 mg., repeated in a month and increasing from the smallest to the largest amount mentioned. It was always mixed with some of the cerebrospinal fluid withdraws, keeping the total amount of fluid injected always less than the total amount withdrawn. He believes that this treatment is also a promising one for cerebrospinal syphilis and general paresis, but there is danger that in these affections the treatment might coincide with the sudden exacerbations to be expected in these two affections. Also in one case where he treated a circumscribed lesion in the lumbar spinal cord by intraspinal injection a violent reaction on the part of the meninges resulted fatally.

**Mendicini, A.** TRAUMATIC PSEUDOTABES. [Policlinico, Feb. 10, 1918.]

Mendicini reports three cases of wounds in which tabetic signs were evident, but in which the course of improvement aided in the diagnosis of traumatic pseudotabes. The symptoms in the first case resulted from a wound of the cauda equina by a scrap of shell. There was extinction of the reflexes, pronounced cough and sneezing sign, ataxia only in walking, lancinating pains and interference with sphincter functioning. There was at first total paraplegia. In the second case, that of an extrameningeal traumatic polyradiculitis, the paraplegia was fleeting and the sphincter functioning unimpaired. The third case gave evidence of lumbosacral hematomyelia. The pseudotabetic symptoms are evidence of an incomplete lesion of the cord and the prognosis is therefore good.

**Castrex, M. R., Queirel, J.** RAYNAUD'S DISEASE AND PAROXYSMAL HEMOGLOBINURIA OF SYPHILITIC ORIGIN. [Prensa Med., Jan. 20, 1918.]

The authors report a case which they diagnosed as ignored syphilis with tobacco poisoning, the latter being held mainly responsible for a permanent vasoconstriction resulting in the marked Raynaud clinical

picture present. The patient had denied syphilis and the Wassermann test was negative, but he acknowledged several attacks of gonorrhea. For seven years there had been occasional hematuria. Raynaud's disease with moist gangrene had been developing for eleven months beginning with a septic ingrown toenail. He had lost 42 lbs. in weight. After suffering greatly once from the cold, though lying in bed, he had voided almost pure blood. The clinical conditions were promptly restored to normal on administration of specific treatment for syphilis, in spite of the negative results of the Wassermann and blood tests.

**Raventos, R.** LUMBAR PUNCTURE IN CHILDREN. [Rev. d. Cienc. Med. de Barcelona, Dec., 1917.]

Reventos emphasizes the importance of lumbar puncture in children as well as the ease and safety with which it can be performed. He believes that proper treatment depends upon the determination of the number of germs in the cerebrospinal fluid and the former neglect of this has been responsible for many deaths. He enumerates the advantages for lumbar puncture which the child has over the adult. The distance from the skin to the dura is less and the meningeal sac reaches down lower proportionately; the tissues are more easily penetrable; the spine is more elastic and permits the vertebrae to be spread further apart than in adults and the spinous processes are shorter and horizontal. He gives illustrations of the exact anatomic conditions in the region taken from fifty-five cadavers also of the trunk cut horizontally at the point where the puncture is made.

**Levinson, A.** HISTORY OF CEREBROSPINAL FLUID. [American Journal of Syphilis, Vol. II, No. 2.]

The existence of fluid in the brain, Levinson finds, was known to the ancients only in pathologic cases and at first as water on the brain. The brain was spoken of as a gland which secreted a fluid which poured into the pharynx. Herophilus (about 300 B. C.) must have observed the cerebrospinal fluid in his many dissections, though no record of such observation is extant. His descriptions of the ventricles refer only to their being the seat of the soul. Later writers even down to Vesalius discuss the localization of the soul and of the different mental faculties without any reference to the fluid. The choroid plexus is mentioned but not as related to the cerebrospinal fluid. Varoli (1543-1575) denied the existence of pneuma in the ventricles, insisting instead that this space was filled with fluid. Domenico Cotugno is credited with the first conventional description of cerebrospinal fluid, though it is also claimed that Valsalva had seen such a fluid in cutting the cord membrane of a dog. In 1764 Robert Whytt described tuberculous meningitis, the manifestations of which he attributed to a serous exudate. Later he included under acute hydrocephalus all cases of acute brain disease in a work entitled "Observations on the Dropsy of the



Brain." Haller discusses this fluid as secreted from the blood but generally escaping again in the form of vapor in the healthy person, the excess, if there is any, descending "through the bottom of the ventricles to the base of the skull and into the loose cavity of the spinal marrow." He thought that the fluid was continued into the small vessels of the medulla and into the nerves, causing both sense and motion.

Magendie was the first to give an actual description of the cerebro-spinal fluid and to give a clearer conception of its workings. He noted the liquid surrounding the medulla as well as the brain and cerebellum, as he expresses it, and to it he gives the name of the cephalorachidian or cephalospinal fluid. He attributes a protective and a lubricating function to the fluid and states the arachnoid secretes even a perspiratory fluid.

In 1856 Middeldorpf performed a cerebral puncture upon the living, but it was Corning who first performed spinal puncture. Although he does not describe his technic, he suggested from his experience in injecting hydrochlorate of cocaine that great therapeutic advantage might accrue. In 1891 W. Essex Winter reported the drainage of spinal fluid in tuberculous meningitis with immediate improvement of symptoms, though the disease in each case later proved fatal. Among those who followed Winter it was Quinke who simplified and perfected spinal puncture and established the technic in use at the present time. He reports successful procedure in hydrocephalus and advises its therapeutic employment in cases of marked cerebral pressure, especially in tuberculous and acute hydrocephalus. He also measured the pressure of the fluid and studied to some extent its chemical composition. Later its value in diagnosis was recognized and reported and its employment for this purpose has advanced rapidly until it has become a routine measure diagnostically as well as therapeutically.

At present research centers chiefly about the source of the cerebro-spinal fluid. Among important theories regarding it is that of Magendie that it is protective in nature; of Gaskell, that it is a primitive digestive juice; of Dandy that it is concerned in respiration through the choroid plexus, which acts as an intracerebral gill. Petit and Gerard believes that the fluid contains an internal secretion, Mott that it circulates in the perivascular and pericellular channels, giving up possibly water and carbon dioxide and taking up oxygen and sugar. Halliburton considers it a Locke's modification of a Ringer's solution which bathes the neurones, others believe that it destroys toxic substance and Mestrezat that it is a dialysate of the plasma on specially differentiated epithelium, like the aqueous humor of the eye.

Every discovery in bacteriology is related to the history of the spinal fluid. Koch's discovery of the tubercle bacillus substituted tuberculous meningitis for the older term acute hydrocephalus, the term meningococcus meningitis came to define better "spotted fever" and

"epidemic cephalalgia" while Fraenckel's discovery of pneumococcus threw light upon the suppurative meningitides. The most marked advance has been made in the study of syphilis. The spinal fluid served as the chief medium in the discovery of the spirochete pallida, of complement fixation and for Ehrlich's work on immunity and Wassermann's serologic test. The Wassermann test in the spinal fluid is one of the earliest and best guides in the diagnosis of syphilis. Chemistry has not yet proved its full therapeutic relationship to the cerebrospinal fluid, but serology has achieved much in this line, though even here there is room for much advance in the future. Physical chemistry is also manifesting its dependence upon the spinal fluid.

**Steiner.** DISSEMINATED SCLEROSIS. [Editorial, Br. Med. J.]

It is said that after locomotor ataxia disseminated sclerosis is the next commonest nervous disease. Very little is known about its etiology, and it has been looked upon as a primary degeneration. Clinically, however, it presents many signs of a specific infection. The first attack is sometimes a very acute illness, and the recurrences suggest the revival of a latent infection. The anatomical lesions in cases which have run an acute course, consisting of inflammatory and exudative changes in the walls of small blood vessels throughout the central nervous system, are very suggestive of infection. These inflammatory changes are, moreover, present in areas where glia is poorly developed, which is against the idea that a primary degenerative change in the glia is the foundation of the pathological anatomy of the disease. Various workers, including Jürgens, Siemerling and Raecke, and Bullock, have attempted to transmit the disease from man to animals without result. Steiner, just before the outbreak of the war, was able to produce in a rabbit by inoculation of cerebrospinal fluid from an acute human case, a disease with marked nervous symptoms, which ended fatally about six weeks after inoculation. Since then further experiments have been carried out, the blood and cerebrospinal fluid from acutely developing human cases being used for inoculation. Guinea pigs, rabbits, mice, and one monkey have been the subjects of the tests, and the inoculations were made intraperitoneally, intracardially, and intraocularly. The authors describe interesting results in guinea pigs after intraperitoneal injections of cerebrospinal fluid, and in rabbits after intraocular inoculations. Control experiments with the blood and cerebrospinal fluid of patients suffering from other diseases, and of healthy persons, were completely negative. In the guinea pig the disease may develop and end fatally at periods varying from three days to twelve weeks. The symptoms all point to involvement of the central nervous system. The animal sits humped up, moves about with difficulty, and finally becomes paralyzed in the limbs. Death ensues as a rule within about nine hours after the onset of paralysis. In rabbits the symptoms are at first not referable to the nervous system. The

animal becomes thin, and its fur dry; later a severe illness sets in suddenly, and ends in paralysis and death. No macroscopic changes have been observed in the experimental animals post mortem, and the histological changes have not yet been worked out. Cultures from the blood and from the organs of the animal were one and all sterile. In films of blood both from the guinea pigs and rabbits, which died with paralytic symptoms, the authors were able to recognize spirochetes. The methods used were dark-ground illumination, Giemsa's stain, and Loeffler's stain. In only one case were spirochaetes found in the animals by Levaditi's silver method, and then only in the liver. The spirochetes are described as morphologically very similar to those of spirochetal jaundice. Under dark-ground illumination they are very actively motile. Further work on the subject is stated to be in progress.

**Hassin, G. B. and Carrol, E. P.** SACRAL TABES. [Journal A. M. A., March 16, 1918.]

The authors say that it was customary formerly to classify cases of tabes according to their localization in the cord. Cases are, however, occasionally met with in which the lesion is principally confined to the sacral roots, and they report such a one, in which the exclusive involvement of the sacral roots produced a classical picture of a lesion of the cornu medullaris, the rest of the cord being found on necropsy to be normal. The authors remark that cases of sacral tabes are scientifically and practically of great value. Their scientific value lies in the fact that they offer unusual opportunities for studying the probable course of the sacral root fibers within the spinal cord, and their practical value lies in the fact that some cases of so-called conus lesion may be nothing but tabes, and they publish their cases strongly suggesting this possibility.

**MacRobert, R. G.** LUMBAR PUNCTURE HEADACHE. [Journal A. M. A., May 11, 1918.]

MacRobert says that lumbar puncture headache differs from all other headaches in that, being present when the patient is sitting up, it completely disappears when he lies down. It is throbbing and severe, and is felt mostly in the frontal and occipital regions, and no drugs give sufficient relief to allow the patient to walk about. Regarding causative or influencing factors of the headache, various speculations have been made concerning the importance of such points as the rapidity of withdrawal of spinal fluid, its degree of pressure at the time of puncture, the position of the patient during the puncture, his age and his disease condition. Some observers believe that lying flat on the back for twenty-four hours following puncture, the presence or absence of syphilis, and the amount of fluid withdrawn, are important. The twenty-four hours' supine position has been the practice in the Neurological Institute. This should give time for the replacement of the

small amount of fluid withdrawn. Out of a series of thirty cases in which this point was strictly adhered to, twelve developed the typical severe headache. His observations do not lead him to put much stress on the presence or absence of syphilis, but the question of the amount of fluid withdrawn is interesting. The equal liability of headache after the withdrawal of 2 c.c. and 20 c.c. has often been demonstrated. While the consensus of opinion is that the amount of fluid withdrawn has an influence, it seems ridiculous, since the amount of cerebrospinal fluid secreted during the day is probably 60 c.c. or more, that the withdrawal of 2 to 5 c.c. could be able to alter the intracranial situation sufficient to cause violent headache of seven or more days' duration. Consideration of these facts leads him to look further for the cause. The author says one can soon convince oneself, by trying it on the cadaver, that a puncture of the intradural membrane usually persists as a clean edged, round hole, and he asks, "Why may there not be a continuous leakage?" The spinal fluid is always under some pressure, and the closure of the puncture hole usually takes place, he thinks, in the following way: The arachnoid tissue, as it drops from the point of the departing needle, is pressed against the dura mater, blocking it, or if this is not the case, it passes through the dural hole forming a sort of spout or wick for the easy drainage of the total cerebrospinal fluid sac. The brain, normally, rests practically on a water cushion which is made less perfect by the withdrawal of fluid, and if the leakage is continuous we may expect the pressure of the brain weight on the clivus of the occipital bone must be greatly increased when the patient sits up. This headache can be understood as due to the sudden "heightened intracranial pressure due to the rise of pressure in the cerebral veins; its entire relief, when patient lies down, as due to the fall of pressure when the weight is removed from the veins on the clivus." In the course of a week the puncture hole fills, the spinal fluid rapidly secretes and the integrity of the brain cushion or water-bed under the brain is restored.

## Book Reviews

**Carroll, Robert S.** THE MASTERY OF NERVOUSNESS. Based upon Self Reëducation. The Macmillan Company, New York.

There is such a strong positive note in this book that it cannot fail to help its readers to a mastery of themselves, which as the author explains, would be a mastery of nervousness. He starts out to show the greatness and power of man in his nervous endowment, the mechanism which has been evolved in him for control and use of his environment through adjustment to that environment. For it is through his nervous system in its reactions to external and internal stimuli that these are accomplished. Yet it is through this system, in a disturbance of these reactions, that he has realized his chief sufferings also.

This disastrous state of things is due not to the insensate nerves themselves, as common speech has it, but to misdirection of energy and effort through these channels of mental activity. Some of these manifestations of uncontrolled response to stimuli are outlined in various types of nervousness. The preparation for such uncontrolled activity which comes through heredity, home training and early education is mentioned. Much attention is given to the difference between over-eating and unwise eating with stress upon the influence upon the tissues of the disproportion of substances taken into the body. Upon eating errors is charged a great deal of the nervous suffering which man endures, and moreover upon the undue attention which he gives to his digestive apparatus. The author has here too greatly exaggerated effect as cause. The gospel of work is preached in clearest terms, as well as that of wisely chosen play, both methods whereby interest and attention are diverted to that form of activity which is the healthy expression of a psychic nature, and which has built it up and directs it to effective ends.

There is recognition of the varied and distracting play of emotions and the need for a reasonable control. The chapter which urges the cultivation of wills rather than ill's defines as will merely that freedom with which one chooses and directs his action along the path which brings the best control of the many emotions and accomplishes the most efficient purpose. From such a point of view rebellion, self-pity, worry, all the discord which weakens and mars life, appears as the result of defective adjustments and lack of wise control. In adopting such an attitude of wise control self will be really fulfilled and harmony realized.

The point of view of the book is stimulating and wholesome, with a just appreciation of the true nature of man in his need for activity and

his truest health therein. The way to this goal is not made clear enough for those who have lost it. Setting the goal before them is not enough. There is need still of a deeper understanding and accounting of the instinctive factors of psychical life and the part they play obscurely hidden from the best conscious endeavor. Only thus is there complete appreciation why effort goes astray in seeking adjustment and help to have these ideals made practicable for those who need them most.

JELLIFFE.

**Ballard, E. Fryer.** AN EPITOME OF MENTAL DISORDERS. A PRACTICAL GUIDE TO AETIOLOGY, DIAGNOSIS, AND TREATMENT. For Practitioners, Asylum, and R. A. M. C. Officers. Philadelphia, P. Blakistons Son and Company.

This book presents in a conveniently epitomized form the chief syndromes in mental disorders with an accompanying brief description of each syndrome. It is to be questioned however whether the approach here to the clinical problems involved will not be more misleading than helpful. The author admits that his brief presentation must necessarily be somewhat dogmatic, but it is doubtful whether there can be any value to the practising physician in making use of such an exposition of mental disorders. Mere descriptions of symptoms and syndromes are more meaningless in this than in any other department of medicine and only serve to give a false security in diagnosis, which can be of no real guide to the understanding and treatment of these disorders.

Beyond an emphasis upon physical causation such as toxic factors, there is little appreciation of the actual dynamic forces at work producing either an effectual and healthy reaction toward life or any one of the disordered manifestations of inability to cope with life's demands. A "psychical instability" is recognized and a "special temperament or diathesis" but they are not followed up as offering interpretative explanation of the form of psychic disturbance which manifests itself, or as directing to the mode of therapeutic approach. Certain unfortunate statements distort or annul a better therapy, which the author may have in mind. Advice to help the patient to face the conflict over instinct, and then render the instinct as unconscious as possible while sublimating it, and specifically to teach the unstable child at puberty the sexual scheme of things and subsequently give him a course of bromides, is confusing to say the least. When further it is advised that such a child should marry early it would seem that mental disorder needs far more insight into its causes and its mechanisms than is schematically outlined here. It would have been better if the writer had adhered to his confessed lack of qualification to speak upon psychoanalysis. As it is his statements are only partially true, for he has not investigated the real principles and methods of psychoanalysis and therefore falsifies its therapy and fails in grasping the understanding of the workings of the mind, sick or well, upon which that therapy is based.

A little more of the unity of mental life underlying the various aberrations has crept into the latter part of the book but the depth and the power and the meaning of the various facts of mental life are not even suggested. The section on shell-shock perhaps comes as near to a recognition of the underlying whole out of which various disorders arise, as any part of the book.

LAMBERTSON.

**Bruce, H. Addington.** HANDICAPS OF CHILDHOOD. New York, Dodd, Mead and Company.

The author of this book has sent it out with the definite purpose of following up his former writings to parents and bringing the latter to a clearer understanding of the psychological responsibility involved in child rearing. Because this is making itself felt as foremost and fundamental in the parents' duty, there is need for enlightenment and emphasis along certain very definite lines. The particular features of the psychology of childhood and of its treatment, which are introduced for discussion, are those which are sometimes fairly obvious but too often considered as of but small moment or practically negligible or they are ignored because of the parents' complete ignorance of these factors, or indeed of any of the details of child psychology.

First of all attention is called to the possibility and importance of detecting and subjecting to early correction traits of mental weakness, feeble-mindedness or conditions which simulate true feeble-mindedness but which are quite possible of correction if promptly and wisely handled. Then such ordinary but immeasurably important factors as that of being the traits manifested by the only child or the handicap of stammering or sleep walking or sulking, all these things are presented from the point of view which recognizes underlying causes, not merely symptomatic recognition of these things. It is emphasized that corrective treatment and adjustment together with prophylaxis all belong must be approached from this side. The whole matter comes back to a question of adaptability and the necessity of training a child to make successful adaptation to the world, rather than to retreat to a distorted world of his own private wishes and reactions and the difficulties, such as these discussed, which arise out of this unfortunate attitude.

For this reason it is shown how success in treatment has resulted from probing childhood sources and beginnings of difficulties, and it is insisted that prophylaxis lies there also. The style of the book is simple but clearly instructive and will compel the attention of those to whom the message is primarily directed.

Some of the conceptions of the dynamic factors active in childhood and underlying the disturbances might be still more comprehensively broadened and yet deepened also in recognizing the unity of striving which is the center of each life. Nevertheless the book is a distinct

contribution to popular thinking in the direction of a thoroughly analytic understanding of the practical psychology of childhood.

JELLIFFE.

**Stevenson, B. L.** SOCIO-ANTHROPOMETRY. AN INTER-RACIAL CRITIQUE. Boston, Richard G. Badger; Toronto, The Copp Clark Co.

This is a brief but compact study of three racial types of Europe, the Teutonic, represented for this study by England and Scandinavia, the Alpine race, represented in Russia and France and the Mediterranean race, of which Italy serves as the illustration. These are given intensive study in regard to the obvious characteristics which make up the material for anthropometry or physio-anthropology. It is the author's purpose to determine from these data which he has gathered here and from the discussion of the more sociological traits, whether the latter run parallel to the former and how far one can be considered dependent upon the other, or can be concluded from the other.

His discussion makes a very interesting and instructive epitome of the history of these respective races and the character of their racial traits, while his conclusions emphasize the futility of approaching either sociological or anthropometric problems through the medium of the other. Sociology is too much concerned with a fluid fluctuating manifestation of human endeavor and human development to be representable in these terms of physical or physio-anthropologic measurement and it cannot be proved that the two run in a parallelism. One feels that Stevenson's conclusion would be even more strengthened and the proper relation of the two forms of study of humanity, as typified in these three important races, made much more clear and emphatic in a still wider definition of sociological development, carrying it still further back and deeper into the energy expression of the human race. For this conditions social development, constantly modifies and enlarges it and offers the interesting and stimulating question as to how far it has been responsible for the very forms and physical traits with which anthropometry works. The study tends in that direction but has only barely suggested it.

JELLIFFE.



# The Journal OF Nervous and Mental Disease

An American Journal of Neurology and Psychiatry  
Founded in 1874

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## Original Articles

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### NOTES ON THE RELATION OF TUBERCULOSIS TO DEMENTIA PRÆCOX

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There has been a recent revival of an old interest in the relation of tuberculosis to dementia præcox. Physicians in hospitals for the insane have for years suspected that some sort of relation holds between the two diseases. Occasional references in the literature have suggested that a certain number of cases of dementia præcox might possibly be regarded as actually tuberculous. Still more recently some American work by Gosline<sup>1</sup> and by Cotton<sup>2</sup> has attracted attention.

On account of extensive statistics available in Massachusetts, we have thought it worth while to communicate the present note, which may bring into view some of the more general aspects of the problem.

<sup>1</sup>Gosline, Newer Conceptions of Dementia Præcox based on Unrecognized Work, Jour. Lab. and Clinical Medicine, Vol. II, No. 10, July, 1917.

<sup>2</sup>Cotton, Corson White, and Stevenson, The Relation of Focal Infections to Nervous Conditions. Read at the American Neurological Association, May, 1917.

We assume that it is not a question of local tuberculosis in the sense of known forms of the meningeal disease that anyone now thinks of tuberculosis in relation with dementia præcox, even though occasional cases of meningeal tuberculosis or of solitary tubercle<sup>3</sup> might be shown to exhibit symptoms indistinguishable from those of dementia præcox. It is not the contention of anyone that dementia præcox is in that simple way to be resolved. It is a more subtle relation than is imagined, namely, a relation with toxins or other chemical products of the disease. In short, the technique of the bacteriologist, serologist and immunologist ought certainly to be brought to bear on the whole question.

There is some reason for supposing that dementia præcox is not so much a disease as a group of diseases having very possibly each a separate genesis or etiology, in fact, so far as Kraepelin, the original deviser of the concept of dementia præcox, is concerned, there seems to be nothing in his account inconsistent with the polyadic theory of dementia præcox. We have elsewhere<sup>4</sup> aired the view that we should perhaps speak of dementia præcox and allied forms of disease as the schizophrenias, following the suggestion of Bleuler that schizophrenia or dissociation of mental processes was the first characteristic feature of the disease. The only monadic thing, logically speaking, about dementia præcox is very probably this selfsame schizophrenia of Bleuler; and Kraepelin himself has gone so far as to even adopt the term schizophrenia as a proper adjective for the description of sundry dementia præcox patients.

Now if the schizophrenias form a polyadic group corresponding with a botanical order, then there could be no insuperable obstacle to the idea that there may be, as it were, a separate genus in the group of tuberculous origin. There might well be a *Schizophrenia tuberculosa*; but if no scientific proof can be brought of a *Schizophrenia tuberculosa* and all we have left is a discovery that sundry cases of tuberculosis present the clinical appearance and follow the clinical course of schizophrenia, then all we would remain with would be a *Tuberculosis schizophrenoides*.

The question then remains quite open so far as any intensive work in the immunological direction goes and I am inclined to think that such efforts as those of Cotton and Gosline are very serviceable in our endeavors to advance knowledge in one of the most obscure parts of psychiatry.

<sup>3</sup> Southard and Canavan, Focal Lesions of the Cortex of the Left Angular Gyrus in Two Cases of Late Catatonia, American Journal of Insanity, Vol. LXXII, No. 3, January, 1916.

<sup>4</sup> Southard, A Key to the Practical Grouping of Mental Diseases, Jour. NERVOUS AND MENTAL DISEASE, Vol. 47, No. 1, January, 1918, pp. 1-19.

If we turn to the question from the limited statistical point of view available from such a series as the Massachusetts autopsy series, we find beyond peradventure that there is a considerable number of cases of dementia præcox which are not tuberculous so far as high standard routine autopsies are concerned. The following brief table shows the autopsied cases available for statistical study.

Autopsies in Massachusetts institutions for the insane ..	5,040
Dementia præcox .....	403 (8 per cent.)
Manic-depressive psychosis .....	339 (7 per cent.)

It is important to consider in all statistical studies of dementia præcox identical figures for the sister disease, manic-depressive psychosis, since both diseases are commonly accounted functional rather than organic in the sense of gross disease of the nervous system. Yet in other respects the two diseases or disease groups are commonly regarded as quite distinct. The following table contrasts the situation with regard to tuberculosis in dementia præcox with that in the manic-depressive group.

	Dementia Præcox	Manic- Depressive
Cases .....	403	339
Deaths assigned to tubercle .....	120	43
Other cases of tubercle .....	181	181
Total proved .....	301	224
? : Adhesions found .....	15	20
Total conceivable .....	316	244
Non-tubercle, anatomically .....	87	95

It will be noted from this chart that a good many more cases died of tuberculosis in dementia præcox than in manic-depressive psychosis (120 in 403 dementia præcox as compared with 43 in 339 manic-depressive). Moreover, when we add into the list the other cases of tuberculosis, present but not the chief cause of death, we find that dementia præcox still leads manic-depressive psychosis in the number of cases of tuberculosis. Three fourths of all cases of dementia præcox die with proved tuberculosis, whereas but two thirds of manic-depressive cases die with the disease.

Without special statistical proof of the matter, it is well known that dementia præcox cases live longer in institutions than do manic-depressive cases and accordingly must have a longer period in which to develop the disease or even in which to catch it. For the moment, however, the question is whether there are any cases of recognized dementia præcox which are demonstrably not tuberculous.<sup>5</sup>

<sup>5</sup> Southard and Canavan, On the Focality of Microscopic Brain Lesions found in Dementia Præcox. Read at Association of American Physicians, May, 1917.

Sundry cases of adhesions in various parts of the body not clearly tuberculous but possibly tuberculous might be added as in Table II to the lists, but with these additions the total number of cases of dementia præcox which had tuberculosis or conceivably might have had tuberculosis during their lives as indicated by the autopsies was 316 in the total 403: the same figure for manic-depressive psychosis stands at 244 in 339. In short, from the anatomical point of view we are left with 87 cases of dementia præcox and 95 cases of manic-depressive psychosis which were anatomically non-tuberculous. We remain then with a group of 87 cases of dementia præcox in which the tuberculous hypothesis could not be raised as to etiology on any anatomical grounds.

ALL CASES OF DEMENTIA PRÆCOX FREE FROM TUBERCULOSIS

Causes of Death	Danvers	Worcester	Taunton	Westboro	Boston	Foxboro	Total
Acute infections . . . . .	19	12	17	10	—	2	60
Chronic infection . . . . .	1	—	—	—	—	—	1
Ileus . . . . .	1	—	—	—	—	—	1
Exophthalmic goiter . . . . .	—	—	—	—	—	1	1
Arteriosclerosis . . . . .	3	2	1	1	1	—	8
Exhaustion . . . . .	—	1	—	—	—	—	1
Chronic nephritis . . . . .	2	—	—	—	—	—	2
Uremia . . . . .	—	1	—	—	—	—	1
Heart lesions . . . . .	—	1	1	1	—	—	3
Retention urine . . . . .	—	1	—	—	—	—	1
Pulmonary edema . . . . .	—	1	—	1	—	—	2
Catalepsy . . . . .	—	1	—	—	—	—	1
Carcinoma . . . . .	—	2	—	—	—	—	2
Pulmonary infarct . . . . .	—	1	—	—	—	—	1
Pancreatitis . . . . .	—	1	—	—	—	—	1
Foreign body . . . . .	1	—	—	—	—	—	1
							87

Table III gives the causes of death in these cases. As will be seen, the vast majority of them, 60 in 87, were deaths due to acute infection. We conclude at this point, therefore, that it is decidedly inaccurate to state that gross autopsy material will ever demonstrate that dementia præcox is always tuberculous. But may it not be that these non-tuberculous cases of dementia præcox are subject to an error of diagnosis? To test this hypothesis we have examined the symptomatology of some non-selected cases from the Danvers collection, having available a symptom catalogue permitting rapid and unprejudiced analytical work.

In Table IV we note in the left-hand column cases dead of tubercle and in the right-hand column cases dead without tubercle. Importantly enough for our study it appears that the average dura-

## DANVERS DEMENTIA PRÆCOX

	†, Tubercle	‡, $\bar{S}$ Tubercle
Cases .....	36	27
Average duration .....	11 + years	11 + years
Cases 1—years .....	3	4
Cases 10 + years .....	14	10
Symptoms in one half the cases .....	3	3
Allopsychic delusions .....	21	16
Dementia .....	21	15
Resistiveness .....	20	[10]
Motor restlessness .....	[13]	13
Symptoms in one fifth the cases .....	22 cases	18
Mannerisms .....	12 >	0
Suicidal acts .....	7 >	0
Somatopsychic delusions .....	5 <	6
Irritability .....	4 <	6
Special symptoms:		
Psychomotor excitement .....	17	11
Exaltation, euphoria, expansiveness	6	5

tion was in both groups of cases somewhat over eleven years. In discussion we may speak of the cases in the left-hand column as the tuberculous cases of dementia præcox and those in the right-hand column as the non-tuberculous, without, however, attempting to state that the tuberculosis in the left-hand column group has anything to do with the symptoms whatever.

The tuberculous victims of dementia præcox are not more subject to dementia than the non-tuberculous, and they appear to be equally subject to delusions of persecution and other allopsychic delusions as are the non-tuberculous. Whatever the dementing process in dementia præcox may at bottom be, it would not appear to be especially altered by the occurrence or non-occurrence of tuberculosis.

When it comes to catatonic symptoms, such as resistiveness and mannerisms, there is, superficially at least, another story. The tuberculous cases are more subject to resistiveness (56 per cent. as against 37 per cent. in the non-tuberculous) and it is curious that not a single case of non-tuberculous dementia præcox happened to exhibit mannerisms (33 per cent. of the tuberculous cases manneristic). Psychomotor excitement also occurs more frequently in the tuberculous group, and there is a slight excess of other maniacal or hypomaniacal symptoms in this group.

Accordingly, one might lay down a hypothesis to the effect that hyperkinesis<sup>6</sup> in dementia præcox was somewhat favored by the occurrence of tuberculosis. The hypothesis, put thus broadly, cannot be upheld, however, since so clearly a hyperkinetic symptom as

<sup>6</sup> Southard, The Association of Various Hyperkinetic Symptoms with Partial Lesions of the Optic Thalamus, *JOUR. OF NERVOUS AND MENTAL DISEASE*, Vol. 41, No. 9, October, 1914, pp. 617-639.

motor restlessness occurs in about half of the non-tuberculous cases. Moreover, there are somewhat more cases of irritability in the non-tuberculous group than in the tuberculous group. Without endeavoring to analyze the nature of motor restlessness and irritability, it is clear that they are in general more peripheral in their seat than such catatonic symptoms as mannerisms and perhaps resistiveness. Certainly psychomotor excitement is far more central an affair than motor restlessness.

Accordingly, the hypothesis that tuberculosis has something to do with the overactivity or hyperkinetic tendency on the part of victims of dementia præcox would have to be modified in one respect. We should have to say that there was a greater tendency to hyperkinesis of central origin in the tuberculous victims of dementia præcox than in the non-tuberculous victims. Of course, the nature of catatonia is such that an actual inhibition and masking of such symptoms as motor restlessness and irritability might be conceived to occur, so that an appendix to the hypothesis might be drawn to the effect that tuberculosis in dementia præcox not only tends to increase psychogenic (cortical) hyperkinesis but also tends to suppress peripheral forms of hyperkinesis.

Omitting reference to such hypothesis, we may state the statistical facts as follows: The tuberculous victim of dementia præcox is statistically more apt to be resistive, violent and subject to spells of psychomotor excitement; slightly more subject to delusions involving personality; and more suicidal, manneristic, disoriented, confused, than non-tuberculous victims; the tuberculous victim is also at times indifferent and apathetic or even depressed. Taking these facts as they stand, another hypothesis might be raised to the effect that the tuberculous victim of dementia præcox takes on more symptoms looking in the direction of manic-depressive psychosis than do the non-tuberculous victims of dementia præcox. Perhaps the real point here is that the somatic feature, tuberculosis, has entered to modify the picture of dementia præcox. Now, inasmuch as we commonly recognize that manic-depressive psychoses are probably somatic (non-encephalic in origin), we should not go far wrong if we claimed that tuberculous dementia præcox ought to show more symptoms resembling those of manic-depressive psychosis than non-tuberculous cases.

A non-tuberculous victim of dementia præcox is statistically more apt to be peripherally restless, at times mute, given to refusal of food and subject to somatic delusions.

As above stated, both groups have in common a tendency to

dementia and to paranoid delusions. They present no large differences in their tendency to auditory hallucinations, insomnia, incoherence, amnesia. The actual figures for the occurrence of these symptoms for the two groups is given in Table V.

Tuberculous		Non Tuberculous	
Cases .....	36	27	
Dementia .....	21	15	(2)*
Allopsychic delusions .....	21	16	(1)
Resistiveness .....	20	10	(8)
Psychomotor excitement .....	17	11	(6)
Violence .....	17	10	(9)
Auditory hallucinations .....	16	12	(4)
Autopsychic delusions .....	16	11	(7)
Motor restlessness .....	13	13	(3)
Disorientation .....	13	6	(14)
Mutism .....	12	12	(5)
Mannerisms .....	12	0	—
Insomnia .....	10	8	(11)
Incoherence .....	10	7	(12)
Amnesia .....	9	6	(15)
Confusion .....	9	4	—
Depression .....	9	6	(16)
Visual hallucinations .....	8	4	—
Indifference .....	8	3	—
Sicchasia .....	7	9	(10)
Suicidal acts .....	7	0	—
Apathy .....	7	2	—
Catatonia .....	7	7	(13)

### SUMMARY

On account of a recent revival of interest in the relation between tuberculosis and dementia præcox, a brief statistical inquiry was made, using data of the Massachusetts autopsy series. It was shown that dementia præcox, found in 8 per cent. of 5,040 Massachusetts autopsies, was far more apt to be terminated by tuberculosis than manic-depressive psychosis, occurring in 7 per cent. of the basic series. 120 of 403 cases of dementia præcox died of tuberculosis, and but 43 of 339 cases of manic-depressive psychosis. 87 cases of dementia præcox showed neither death due to tuberculosis nor any anatomical feature whatever (even including adhesions in various parts of the body) which would conceivably be related with tuberculosis. 95 cases of manic-depressive psychosis were equally free from tuberculosis.

The question whether these non-tuberculous cases of dementia

\* These figures in ( ) refer to the ordinal place in series in which the symptoms belong.

præcox were actually victims of the disease and not subject to erroneous diagnosis was taken up in the statistical study from the Danvers symptom catalogue from which 36 cases dead of tubercle were taken to contrast with 27 cases dying without the slightest evidence of tuberculosis whatever. Some of the most characteristic symptoms of dementia præcox were found equally distributed in the two groups and strongly represented in both, so that no major doubt can be raised as to the accuracy of the diagnosis of dementia præcox in the non-tuberculous group. For example, the fundamental symptoms of dementia and delusions of paranoid type are found equally represented in both. Nor was it found that the fundamental symptom, dementia, was more frequently shown in the fatally tuberculous cases than in the others.

An interesting question is raised by the distribution of hyperkinetic and catatonic symptoms. Tuberculosis appears to dispose certain cases to catatonia and to hyperkinetic symptoms of a presumably psychogenic or cortical nature. Per contra, the non-tuberculous cases showed more instances of the peripheral symptom, motor restlessness, than did the tuberculous cases. Can it be true that tuberculosis inclines the dementia præcox victim more to catatonia (*central* hyperkinesis) and less (perhaps by processes of inhibition) to *peripheral* forms of hyperkinesis than do the conditions that prevail in the non-tuberculous group?

Another hypothesis raised by this statistical study is whether tuberculosis does not cause a trend of symptoms in dementia præcox over toward manic-depressive psychosis. Does not the superposition of a somatic feature like tuberculosis upon the encephalic or psychogenic picture of dementia præcox cause also a superposition of sundry features showing an alliance with those of manic-depressive psychosis? Or, put more briefly, does not tuberculosis tend to make dementia præcox look more at times like manic-depressive psychosis than dementia præcox is ordinarily likely to look?



## REPORT OF A CASE OF SPINA BIFIDA OCCULTA IN CERVICAL REGION

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Spina bifida occurs not infrequently as shown by the fact that in England during the year 1882, 647 deaths were reported as due to this condition. Presumably most of these deaths occurred shortly after birth and were due to the more marked instances of failure of the vertebral plates to close resulting in meningocele or possibly meningocele.

All varieties of spina bifida occur most frequently in the lumbosacral region, whereas, among 385 cases which had been operated upon, Moore<sup>1</sup> found only 9½ per cent. occurring in the cervical region. It has been estimated that of all varieties in all regions the occult comprises only 5 per cent.<sup>2</sup> Brickner,<sup>3</sup> in 1909, collected altogether 85 cases of spina bifida occulta from the literature. He failed to speak of the proportion of cases in which the cervical region was involved. From these references it seems obvious that the type referred to in the title of this paper is uncommon and the brief presentation of a case may be justified.

CASE I.N., 13 years of age.

*History.*—A family history was obtained for two generations only. The father is 43 years old and is "tuberculous." The mother died at 38 years, 10 days following childbirth. According to the patient the mother was "paralyzed," the paralysis beginning one year before her death and gradually involving the upper and later the lower extremities. No further details concerning this disorder were learned. A sister of the mother had no knowledge of it. A brother 21 years of age is "healthy." A brother 10 years of age is "nervous." A brother died at 3 years, cause unknown, and a sister died in infancy. Of these the oldest brother is the only one born before the patient.

As far as known the birth of the patient was at full term, not difficult and followed an uneventful pregnancy. She cried a great deal as an infant and was constipated, but otherwise seemed well.

<sup>1</sup> Jas. E. Moore, *Journal of Surgery, Gynecology and Obstetrics*, August, 1905.

<sup>2</sup> Augustus Thorndike, *Reference Handbook of Medical Sciences*, 1917.

<sup>3</sup> Walter M. Brickner, *Medical Record*, May, 1909.

She walked between one and two years of age and the aunt believed that talking and eruption of the teeth occurred at the "usual time."

She had diphtheria, measles, chickenpox and whooping cough at intervals after the age of 6, but none of these was followed by sequelæ.



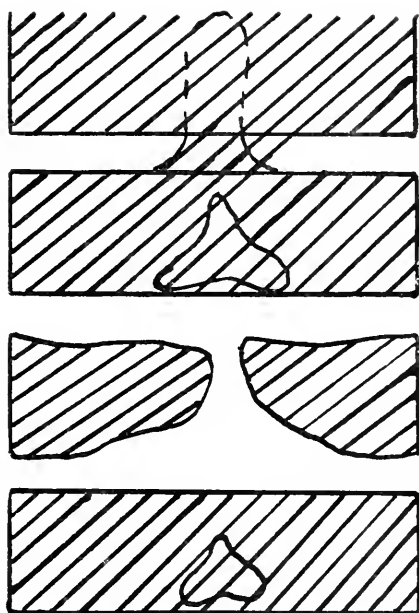
CASE I. N., Dimple with tuft of hair between fourth and fifth cervical spines.

She attended school and learned rapidly; at 13 years was in the seventh grade. She made friends easily and was of a happy, cheerful disposition.

It was noted from birth that the patient had a small depression in the median line on back of neck out of which grew a small tuft of hair. Although the upper extremities seemed to develop normally the patient never was able to use the hands as well as the ordi-

nary child. She could sweep, carry or push objects of weight and play ordinary games in which finer movements of the hands were not involved. She was not clumsy except in buttoning the clothing, in tying laces, in doing fancy work, etc., but in these and other activities in which finer movements were necessary she was so slow as to preclude the doing of any but necessary tasks. She dressed and undressed herself, but did so slowly and was aided whenever speed was desired. Piano playing was attempted but quickly dropped as being too difficult.

*Examination.*—The girl was of moderate height for age and well nourished. She was slightly inclined to obesity. The tonsils were large and cryptic. The cardiac dullness extended about a



CASE I. N. Diagram sketched from X-ray plate showing cleft in third cervical vertebra.

centimeter to left of mid clavicular line and there was heard a soft blowing systolic murmur over apex; not transmitted. There were no other evidences suggestive of visceral disease.

On the posterior surface of the neck in median line between the fourth and fifth cervical spines was found a depression in skin about an eighth of an inch in depth, out of which a small tuft of hair half an inch in length was growing.

Skiagraph showed no defect in the fourth or fifth cervical vertebrae but a cleft in the arch of the third.

Both hands were sufficiently well developed that to casual inspection no abnormality was noticed. On examination, however, it was noted that the fingers were hyperextensible. This was more marked on left side; occasionally the fingers on this side were

slightly hyperextended even at rest. This was a little more marked in little and ring fingers than in the remaining two. Each finger was of ordinary contour and there was no evidence of trophic disturbance. Muscular power was deficient on both sides in little and ring fingers. This was noted in flexion and extension but more particularly in abduction and adduction. She could not quite approximate little finger to ring finger when latter was adducted on either side. Weakness was not demonstrable in simpler movements of index and middle fingers. The grip on right side registered 26 with dynamometer and 22 on the left. The defect was evident in all fingers of both hands in finer movements. She was very slow and clumsy in approximating in turn the fingers to thumb and in buttoning clothing. This difficulty became more marked when eyes were closed. In fact it seemed impossible for her to button a coat placed on her lap unless she was looking at it. In spite of this apparent defect of coördination the finger-finger and finger-nose tests were well done, except for error of three quarters of an inch on first two trials with left hand in latter tests. With eyes closed she accurately followed one hand moved passively about with the index finger of the other hand and correctly imitated with disengaged fingers the position in which the examiner had placed the fingers of other hand.

There were no subjective symptoms of disturbed sensibility and careful examination of parts involved failed to show defect in tactile, pain or thermal sensation either in acuity or in rapidity of conduction of stimuli.

The triceps, biceps and supinator longus reflexes were moderately brisk and were equal on the two sides. There was no flaccidity, spasticity or tremor demonstrable.

Except as mentioned the patient was quite well developed. Particular attention was given to the feet, but there was no suggestion of club-foot or other type of malformation.

The neurological examination, except for the evidences of defect of innervation of fingers, gave negative results. The special senses were normal. Although tactile, pain and thermal sensibility was carefully tested over entire surface of body no defect was found. Heel-to-knee test was well done, Rombergism was not present and sense of position was normal. There were no palsies or involuntary movements. The knee-jerks and ankle-jerks were moderately brisk and equal on the right and left sides. Ankle-clonus and the Babinski, Oppenheim, Gordon and Chaddock reflexes were not present.

Although no detailed discussion of the case will be attempted brief reference to some of the facts in the case may be made. Brickner<sup>4</sup> states in regard to his cases that "heredity played no rôle and coincident congenital deformities were rarely found." No obvious congenital defects, other than those related to the spina bifida, were present in this case. In regard to heredity a tare is suggested in the facts that the father is tuberculous and that, of the two brothers

<sup>4</sup> Ibid.

<sup>5</sup> Gordon Holmes, *British Medical Journal*, 1915.

and the sister born after the patient, one is "nervous" and the others dead. The statement of the patient in regard to the illness which preceded the death of the mother may also be remembered in this connection although too indefinite to permit any deductions.

According to a number of writers there is, in some of the cases of spina bifida occulta, an increase in the peripheral disturbance, presumably due to adhesions involving the roots, as, with growth, there is proportionate shortening of the cord in the canal and consequent dragging upon the roots. In this case there is no history of such increase which may be taken as presumptive evidence that if adhesions exist they do not involve the roots.

In regard to site of the lesion there may be some difference of opinion. The peripheral disturbance was not only definitely motor in type but the inability to button coat with eyes closed although she could do so slowly, with eyes intent upon the task, suggests a disturbance in the deep sensibility even in the absence of other demonstrable evidences of involvement of afferent fibers. The absence of atrophy and of tactile, pain and temperature disturbance speaks for a cord rather than nerve lesion. The peripheral distribution of the motor disturbance is segmental in type corresponding approximately to the seventh and eighth cervical and the first dorsal roots which enter the cord a segment or two above the intervertebral foramina from which they take exit. The term "approximately" must be used, as it was impossible exactly to define the limits of the parts involved.

An attempt to correlate the peripheral disturbance with the defect in development of the third cervical vertebra is hardly possible, but as a matter of fact there need be no direct relationship between the vertebral cleft and the peripheral disturbance. It may be said rather that the cleft shows evidence of a general tendency to failure of development in this region. The fact that the dimple lies between the fourth and fifth cervical spines is evidence that the defect is not limited to the third cervical vertebra and parts immediately adjoining. It is possible that the actual lesion in the cord is caused by a defect in the region of the lower cervical vertebræ not visible in the X-ray. Norman Sharpe<sup>5</sup> cites a case of spina bifida occulta in which although the cleft was present in all vertebræ from the fifth cervical to the sixth dorsal the peripheral disturbance was limited to tingling of the hands and fingers and areas of hypalgesia and hypesthesia on the outer side of left upper arm. Here too the disproportion between the vertebral defect with the clinical evidences of neural involvement is obvious.

<sup>5</sup> Norman Sharpe, *Annals of Surgery*, Feb., 1916.

A CONTRIBUTION TO THE STUDY OF THE PATHOL-  
OGY OF HUMAN AND EXPERIMENTAL POLIO-  
MYELITIS, BASED ON CASES OCCURRING  
DURING THE EPIDEMIC OF 1916 IN  
NEW YORK CITY<sup>1</sup>

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FROM THE DEPARTMENT OF NEUROLOGY, COLUMBIA UNIVERSITY

(Continued from page 126)

CASE 5. Serial No. 505. Source, Bellevue Hospital. Ma-  
terial: From spinal cord.

*Spinal Cord*

*Pia Mater.*—The pia is considerably thickened rather evenly over the entire section. The thickening consists chiefly of edema. The lymph spaces are wide and for the most part empty; however, there is some exudate around the anterior spinal artery and on the anterior surface of the cord. The blood vessels are normal except for a slight degree of hyperemia. There is no infiltration of lymph elements and no proliferation of the fixed connective tissue cells.

*Anterior Horn.*—The blood vessels which enter the cord on all surfaces show hyperemia and infiltration of the Virchow-Robin lymph spaces with lymphocytes and a very few plasma cells. This, as in most cases, is most marked in the distribution of the anterior spinal arteries. There is considerable fresh hemorrhage, lying for the most part perivascularly, diffusely scattered through the central gray. Small lymphocytes are seen in considerable numbers lying free in the gray tissue.

*Ganglionic Cells.*—The single block of tissue received is from the lower dorsal cord and sections from this show no remains of motor cells in the anterior horns. Clusters of cells—polyblasts, lymphocytes and glia cells—are seen scattered throughout the anterior horn. The cells of the cornu lateralis are better preserved, but are decreased in number, and most of those which remain show acute cloudy swelling and neuronophagy by means of polyblasts and glia cells.

*Posterior Horn.*—Many of the cells of Clarke's column appear normal, while in others a beginning neuronophagy is evident. Here the phagocytic cells are undoubtedly of neuroglia origin. The cells of the posterior horn appear on the whole rather normal, but they are somewhat decreased in number.

*White Matter.*—The white matter appears normal.

CASE 6. Serial No. 506. Source, Bellevue Hospital. Material: From spinal cord.

*Spinal Cord*

*Pia Mater.*—The pia is thickened and edematous and contains a fibrinous exudate on its anterior surface, especially around the anterior spinal artery. In all the lymph spaces small lymphocytes are to be seen in considerable numbers. These changes are rather diffusely spread over the entire cord. The blood vessels show moderate hyperemia but no changes in their walls. The connective tissue cells are not increased in number.

*Anterior Horn.*—The blood vessels in the white and gray matter show a diffuse lymph-space infiltration with lymphocytes, which is considerably more marked in the branches of the anterior spinal artery. The nerve tissue, both white and gray, is edematous, but there are no hemorrhages and there has been no escape of lymph elements from the lymph spaces.

*Ganglionic Cells.*—The anterior horn cells are on the whole well preserved, many showing normal tigroid bodies. Most of the cells, however, show acute cloudy swelling with large palely staining nuclei, and very rarely one sees beginning vacuole formation in the cytoplasm. There is but slight increase of neuroglia in the anterior horns and no evidence of neuronophagy.

*Posterior Horn.*—In the posterior horns, singularly, the process seems to be more severe. Many of the posterior horn cells have disappeared. The neuroglia is increased in amount. Polyblasts are evident in the structure and some of the swollen nerve cells which remain show beginning neuronophagy by glia cells and polyblasts.

*White Matter.*—The white matter in all stains appears normal.

CASE 7. Serial No. 507. Source, Bellevue Hospital. Material: From spinal cord.

*Spinal Cord*

*Pia Mater.*—The pia mater over the entire cord section is thickened, edematous and contains a fibrinous exudate. There is also a very moderate degree of lymphocytic infiltration of the lymph spaces and possibly some slight increase of the connective-tissue cells. The blood vessels show the usual hyperemia with normal walls.

*Anterior Horn.*—The branches of the posterior spinal arteries show little evidence of infiltration of the Virchow-Robin lymph spaces, while those of the lateral arteries contain much more, and those of the anterior spinal group occupy a position intermediate with the others. Vessel sheath infiltration is not as striking a feature as in those cases described before. As the result of this one finds the typical pathological changes in the zona intermedia more marked than in either the anterior or posterior horns. In the nerve tissue, in both the gray and white matter, signs of considerable edema are seen.

*Ganglionic Cells.*—In the anterior horn there has apparently been no destruction of the motor cells, as these are present in normal numbers, but all show acute cloudy swelling of considerable degree.



FIG. 12. Section of anterior horn. Human case No. 507.  $\times 300$ , showing single vacuolization without neuronophagy or chromatolysis.

Many of the ganglion cells show one or more large vacuoles in the cytoplasm. There is no increase in the neuroglia cells and no invasion of the tissue with lymphocytes or polyblasts. Neuro-



nophagy is not present. In the zona intermedia the neuroglia cells are increased in number and many polyblasts are present. Here the swollen nerve cells stain less deeply, the nuclei appear paler and a

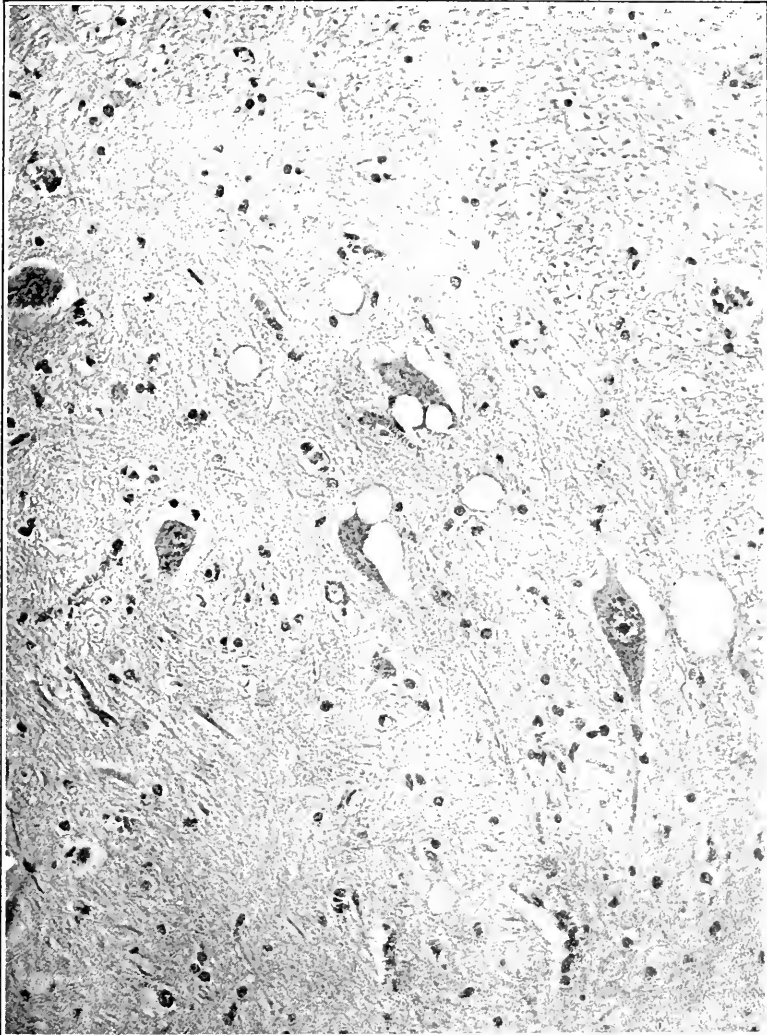


FIG. 13. Section of anterior horn. Human case No. 507.  $\times 300$ , showing multiple vacuolization without neuronophagy or chromatolysis.

number of the cells have undoubtedly disappeared and evidences of beginning neuronophagy, in the main by means of glia cells, are amply evident. (Figs. 12 and 13.)

*Posterior Horn.*—Both the nerve and neuroglia cells appear normal except for the acute cloudy swelling of the former, which is to be expected.

*White Matter.*—The white matter appears normal.

CASE 8. Serial No. 508. Source, Bellevue Hospital. Material: From spinal cord.

### *Spinal Cord*

*Pia Mater.*—The pia is thickened with edema, hemorrhage, and some diffuse fibrinous exudate, and the infiltration of the tissue spaces with small lymphocytes is considerable—much more than is seen in most of our cases. The blood vessels show the usual hyperemia.

*Anterior Horn.*—The blood vessels of the cord everywhere show infiltration of the Virchow-Robin spaces. The most striking feature in this case is the massive invasion of the anterior central gray by plasma cells, lymphocytes and a few polymorphonuclear leucocytes, which appear both scattered in the tissue and in groups of a hundred or even more.

*Ganglionic Cells.*—In sharp contrast to this the ganglionic cells appear normal. There are no evidences of acute cloudy swelling for most of the cells show normal outlines and in many the tigroid bodies are preserved quite as well as one sees them in normal material. In a few of the cells some of the tigroid material has disappeared and beginning neuronophagy can be seen along the edges of these latter cells, but the same process can also be seen in some cells which appear perfectly normal. There appears to be but slight increase in the neuroglia elements.

*Posterior Horn.*—In the zona intermedia and posterior horns the nerve and neuroglia cells appear normal and there is no invasion of the tissue by lymphocytes and polyblasts.

*White Matter.*—The white matter appears normal except for slight edema on the surface of the cord.

CASE 9. Serial No. 509. Source, Bellevue Hospital. Material: From spinal cord.

### *Spinal Cord*

*Pia Mater.*—The pia mater is swollen and thickened; its vessels are dilated and filled with blood. Here and there small hemorrhages are seen between the pial layers. Cellular infiltration is not marked. The fold of pia in the anterior spinal fissure in its deepest portion shows a moderate cellular accumulation.

*Anterior Horn.*—The blood vessels in the substance of the cord show some increase in cells in the adventitial lymph spaces. This is most prominent in the branches of the anterior spinal vessels.

*Ganglionic Cells.*—The motor cells of the anterior horns in almost every instance appear normal. The nuclei are placed in the center of the cells and normal tigroid substance is to be seen in the cytoplasm. There is no evidence of edema, hemorrhage, or cel-

lular infiltration in any portion of the gray matter. There seems to be no increase of neuroglia.

*Posterior Horn.*—The cells of the column of Clarke and other

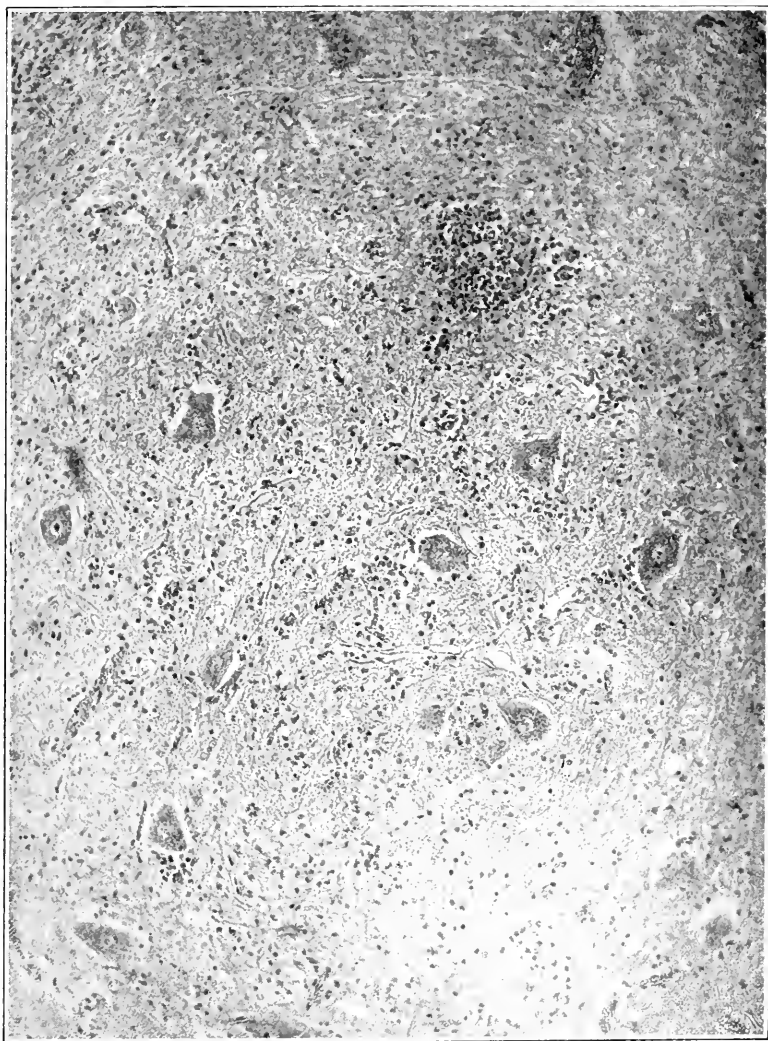


FIG. 14. Section of anterior horn. Human case No. 508.  $\times 150$ , showing predominating mesodermogenic tissue type of reaction.

posterior horn cells appear normal. As in the anterior horn, there is no hemorrhage, edema, or cellular infiltration.

*White Matter.*—The white matter appears normal. In this case we seem to have simply an infection of the mesodermogenic tissue elements.

CASE 10. Serial No. 510. Source, Willard Parker Hospital. Material: From spinal cord, cerebellum and cerebral hemispheres.

### *Spinal Cord*

*Pia Mater.*—The pia covering the surface of the cord is uniformly thickened and edematous. Its blood vessels are dilated and congested. There is a good deal of free hemorrhage in the pial spaces. On the surface of the pia and between its layers is to be seen a moderate amount of fibrin. There is everywhere an infiltration of small round cells most of which appear to be lymphocytes. This cellular accumulation is most pronounced in the neighborhood of the anterior spinal vessels and in the pial fold of the anterior spinal fissure.

*Anterior Horn.*—The blood vessels throughout the cord everywhere show perivascular infiltration. The vessels themselves are very much dilated and filled with blood. Small capillaries are in evidence everywhere throughout the section.

*Ganglionic Cells.*—The ganglionic cells of the anterior horns have entirely disappeared and have left no evidence of their former situation. There are no localized collections of phagocytic cells, although there is a diffuse cellular infiltration through the gray matter, the anterior to a less extent than the posterior horns. There are a number of small and moderate-sized hemorrhages scattered throughout the anterior horns. Invading cells seem to be largely lymphocytes and polyblasts, though some of them are ameboid glia cells.

*Posterior Horn.*—There remain a very few ganglionic cells in the posterior horns. All of them show the changes of marked acute cloudy swelling.

*White Matter.*—The white matter appears normal.

### *Cerebellum*

*Pia Mater.*—There is a well-marked meningitis. The pial vessels are everywhere congested. There have been only slight hemorrhages and there is but little fibrinous exudate. Everywhere, however, the pial spaces are crowded with cells. These cells are for the most part large and small lymphocytes though there are some polymorphonuclear leucocytes and a few plasma cells.

*Cerebellum.*—The substance of the cerebellum appears normal. There is some vascular congestion but no perivascular infiltration or other evidence of inflammation.

### *Cerebral Hemisphere*

*Pia Mater.*—The pia is edematous and its vessels are congested, but there is no other evidence of inflammation. (See Fig. 3.)

*Pallium.*—The blood vessels in the substance of the brain are congested. The nerve cells throughout the cortex seem normal, and there is no hemorrhage nor cellular infiltration to be seen.

CASE 11. Serial No. 511. Source, Bellevue Hospital. Material: From spinal cord, pons, cerebellum and a portion of the cerebral hemispheres.

*Spinal Cord*

*Pia Mater.*—The pia mater is swollen and thickened over the anterior surface of the cord. There is some fibrinous exudate on the surface and a slight amount between the pial layers. The blood



FIG. 15. Section of anterior horn. Human case No. 510.  $\times 50$ , showing cellular dissolution causing complete disappearance of anterior horn cells without neuronophagy.

vessels are markedly congested and there are some hemorrhages into the pial substance. There is very little infiltration with lymphocytic cells.

*Anterior Horn.*—The branches of the anterior spinal artery are moderately congested. The Virchow-Robin spaces show very little infiltration. There is very little edema and no hemorrhage to be seen anywhere. The anterior horn cells, except for a slight acute cloudy swelling, appear singularly normal. There is no cellular infiltration of the glia matrix.

*Posterior Horn.*—There is slight congestion of the blood vessels in this region of the cord. No hemorrhage or edema was observed. The Virchow-Robin spaces showed no infiltration in the posterior horn. The cells in the column in Clarke and the other collections in the posterior horns were normal.

*Pons.*—The blood vessels throughout the pons are markedly dilated and congested. The perivascular lymph spaces are very wide, manifesting an unusual degree of dilatation. The cellular elements in the spaces are for the most part large lymphocytes, in addition to which there are a few small lymphocytes and a few polymorphonuclear leucocytes. Throughout the substance of the pons there is more or less infiltration which is diffuse in its character and occasioned by the presence of polyblasts and ameboid glia cells. The outstanding pathological feature of this case is the fact that the large ganglionic cells of the pons have very uniformly undergone a fat pigmentary degeneration. This process is shown in Fig. 16. There is no evidence of neuronophagy.

*Cerebral Hemispheres.*—The pia mater over the cerebral hemispheres showed a slight degree of hemorrhage with every little or no infiltration. There was also a considerable amount of edema present in the pia. The pallium showed no changes in any of its elements.

#### *Cerebellum*

*Pia Mater.*—The pia over this part of the brain was involved in about the same way as that covering the cerebral hemispheres. There was a slight amount of hemorrhage with edema between the pial layers. The substance of the cerebellum, both white and gray matter, was entirely normal, and the cell of Purkinje were normal in all respects.

CASE 12. Serial No. 512. Source, Presbyterian Hospital. Material: From spinal cord and pons.

#### *Spinal Cord*

*Pia Mater.*—The pia covering the cord is everywhere swollen, thickened, and has a fibrinous exudate on its surface and into its spaces. Its blood vessels are moderately congested and there are slight hemorrhages to be seen in a few places. There is very little evidence of cellular infiltration.

*Anterior Horn.*—In the substance of the cord, the blood vessels show moderate infiltration of the Virchow-Robin spaces. This is as usual more marked in the branches of the anterior spinal vessels.

*Ganglionic Cells.*—In the anterior horns the ganglionic cells have largely disappeared. One or two are seen which appear com-

paratively normal. There is no localized cellular accumulation to be seen anywhere. Throughout the anterior horns, there is proliferation of the neuroglia cells.

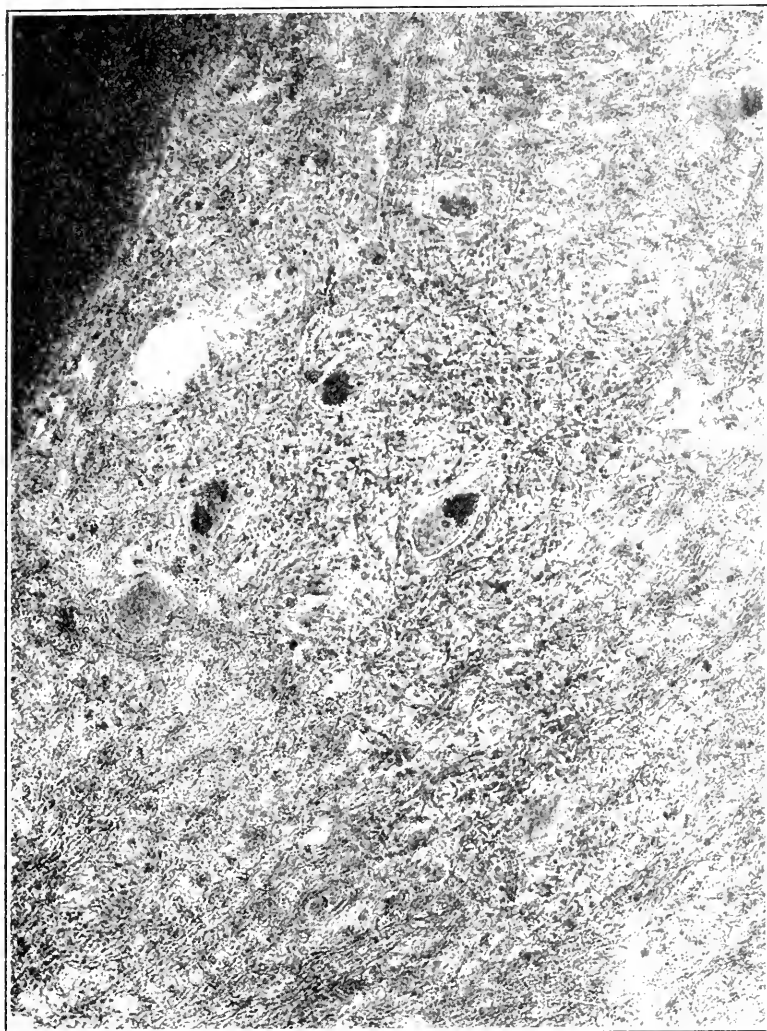


FIG. 16. Ganglionic cells of the pontile nucleus. Human case No. 511,  $\times 300$ .  
Fatty pigmentary degeneration without neuronophagy or chromatolysis.

*Posterior Horn.*—The cells of the posterior horns and of the column of Clarke appear normal.

*White Matter.*—The white matter shows no pathological alterations.

*Pons.*—There are no changes to be seen other than those in the pia as described in the section of the cord, and a generalized vascular congestion throughout the entire section. The nerve cells appear



FIG. 17. Section of anterior horn. Human case No. 512,  $\times 150$ . Cellular dissolution causing complete disappearance of anterior horn cells without neuronophagy.

normal. There is no perivascular infiltration, hemorrhage or cellular infiltration.



CASE 13. Serial No. 514. Source, Bellevue Hospital. Material: From medulla, cerebellum and cerebral hemisphere.

*Medulla.*—There is moderate swelling and edema of the pia. Its vessels show a moderate amount of hyperemia. In places there is some fibrinous exudate on the pial surface and in the pial spaces. There are no hemorrhages to be seen. Very slight cellular infiltration. In the substance of the medulla the blood vessels show rather pronounced perivascular infiltration. This is especially true of the vessels beneath the floor of the fourth ventricle. The vessels throughout the entire section are markedly congested. In a few areas small hemorrhages into the tissues surrounding the vessels are to be seen. The nerve cells throughout the entire section appear normal. No evidence of cellular infiltration or of neuroglia proliferation is to be seen.

#### *Cerebellum*

*Pia Mater.*—The pial membrane is thickened. This is largely due to edema and hemorrhage. There is practically no fibrin formation and few white blood cells present.

*Cerebellum.*—The substance of the cerebellum appears normal.

#### *Cerebral Hemispheres*

*Pia Mater.*—The pia over the surface of the convolutions is very edematous. Its vessels are dilated and filled with blood. There is moderately diffuse infiltration of the pial lymph spaces, large and small lymphocytes, and a few polymorphonuclear leucocytes. There are also a few cells which seem to be proliferated endothelium. The cerebral cortex appears unchanged. There is no Virchow-Robin space infiltration.

CASE 14. Serial No. 515. Source, Willard Parker Hospital. Material: From spinal cord, cerebellum and cerebral hemispheres.

#### *Spinal Cord*

*Pia Mater.*—A good deal of the pia has been stripped off this section but that remaining over the anterior portion of the cord and in the anterior fissure is not normal. The blood vessels are congested. There are slight hemorrhages and a slight diffuse cellular infiltration. The pia is swollen and edematous and there is some fibrinous exudate on the surface.

*Anterior Horn.*—The blood vessels are congested and there is slight perivascular infiltration in the branches of the anterior spinal vessels. There are no hemorrhages and little edema. There is a slight diffuse infiltration of cells throughout the anterior horns. The character of the cells is difficult to determine but they appear to be lymphocytes for the most part.

*Ganglionic Cells.*—The ganglionic cells of the ventro-lateral group have largely disappeared leaving no trace of their former location. The other anterior horn cells show advanced acute cloudy swelling. There is no evidence of neuronophagy.

*Posterior Horn.*—There is but slight vascular congestion and no

infiltration of the Virchow-Robin lymph spaces. There are no hemorrhages nor is there edema.

*Ganglionic Cells.*—Some of the cells show a slight degree of acute cloudy swelling but for the most part they are normal.

*White Matter.*—The white matter is normal.

### *Cerebellum*

*Pia Mater.*—The blood vessels are very much dilated and congested. There are numerous hemorrhages and much edema is evident. There is but little cellular infiltration.

*Cerebellar Cortex.*—There is a marked congestion of all the vessels but no perivascular infiltration nor hemorrhages. In some portions of the molecular layer there are localized areas of necrosis. In these areas there is a destruction of the substance of the molecular layer and in infiltration of cells. The invading cells are for the most part polyblasts, though there are some lymphocytes and polymorphonuclear leucocytes. The Purkinje cells in the vicinity of these necrotic areas are swollen and granular with the nucleus often eccentrically placed and staining poorly. Others show more severe degenerative processes with almost complete destruction of the cell body and nucleus. The granular and medullary layers appear normal.

### *Cerebral Hemispheres*

*Pia Mater.*—The pia is very much swollen and edematous. The blood vessels are markedly congested. There are no hemorrhages and there is no cellular infiltration nor fibrinous exudate.

*Pallium.*—The blood vessels are congested and some of them show slight infiltration of the Virchow-Robin spaces. There is no hemorrhage nor edema and no evidence of cellular infiltration. The ganglionic cells appear normal.

CASE 15. Serial No. 516. Source, Willard Parker Hospital. Material: From spinal cord, cerebellum and cerebrum.

### *Spinal Cord*

*Pia Mater.*—All portions of the pia surrounding the cord show signs of inflammation. It is, perhaps, more marked over the ventral region and in the anterior spinal fissure. The blood vessels are markedly congested. The layers of the pia are separated by hemorrhage and edema. There is also a good deal of fibrinous exudate both into the pial substance and on its surface. There is a slight infiltration of leucocytes. This is most noticeable in the pial fold in anterior spinal fissure.

*Anterior Horn.*—The branches of the anterior spinal vessels are markedly congested and the Virchow-Robin spaces are crowded with cells. There are no hemorrhages to be seen but the glia matrix is quite edematous. There is a diffuse cellular infiltration, the cells being principally polyblasts and ameboid glia cells. There is some proliferation of neuroglia. (Fig. 18.)

*Ganglionic Cells.*—The ganglionic cells of the anterior horn, ex-

cept those of the ventro-lateral group, have for the most part disappeared and left no trace of their former situation. Some of those that remain appear normal. A few show evidences of acute

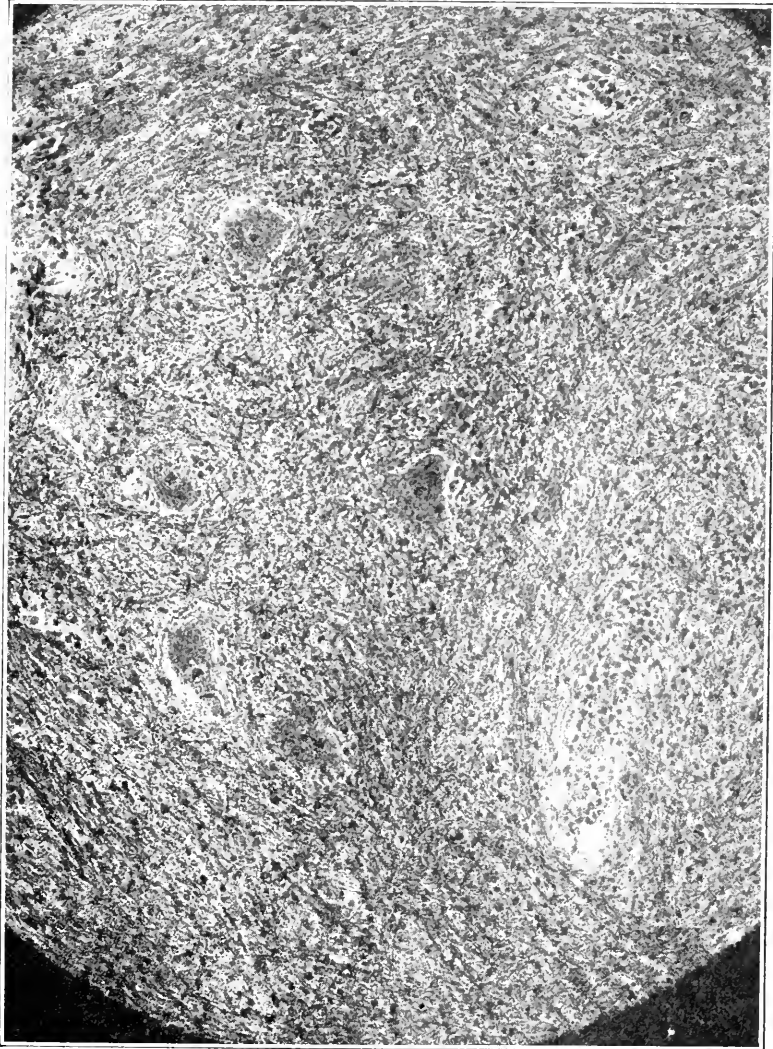


FIG. 18. Section of anterior horn. Human case No. 516,  $\times 150$ , showing predominating mesodermogenic type of reaction.

cloudy swelling and in one or two places there is commencing neuronophagy, the neuronophagocytes being polyblasts.

*Posterior Horn.*—In the posterior horn a somewhat similar picture is seen, though less marked. There is vascular congestion,

perivascular infiltration, edema, and one or two small hemorrhages. Throughout the entire gray matter there is a moderate diffuse cellular invasion.

*Ganglionic Cells.*—The ganglionic cells are better preserved than

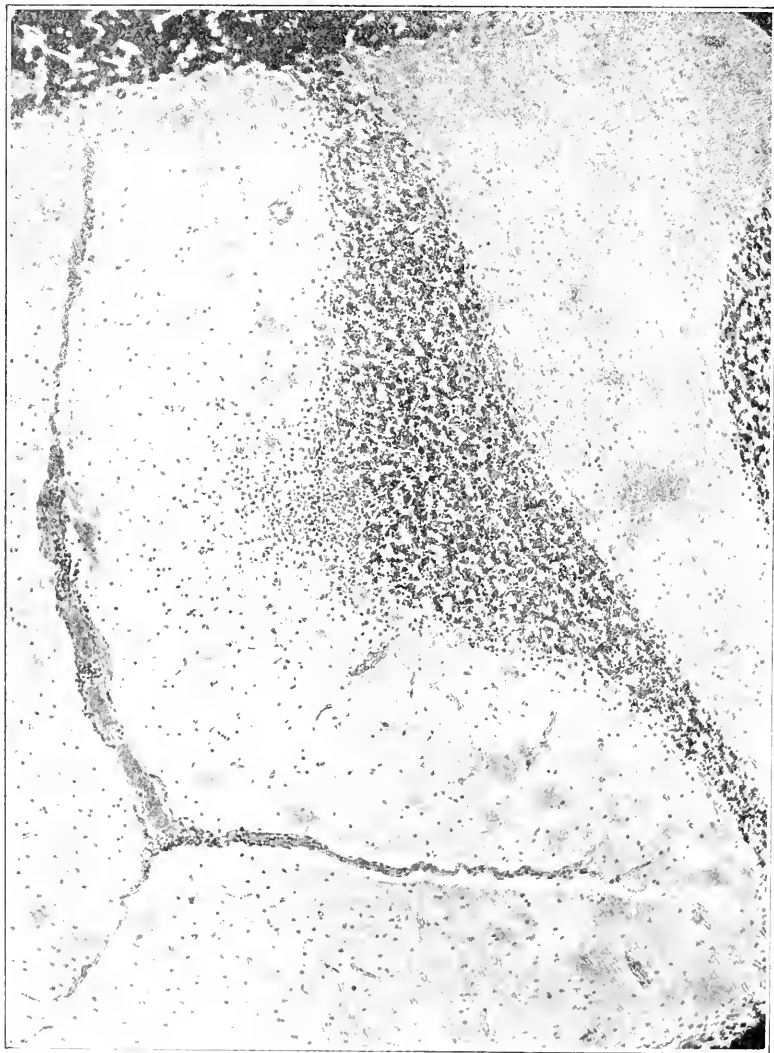


FIG. 10. Section of cerebellum. Human case No. 510,  $\times 150$ , showing the mixed type of inflammatory reaction affecting the cerebellum in which there are alterations in the mesodermogenic elements and cells of Purkinje.

in the anterior horns, but some of them have disappeared. Those which remain show mild acute cloudy swelling. The cells of the column of Clarke are well preserved and appear normal.

*White Matter.*—The blood vessels in the white matter are congested and show perivascular infiltration. Otherwise, it is normal.

### *Cerebellum*

*Pia Mater.*—The pia is somewhat swollen and edematous. In places there are hemorrhages and fibrinous exudate. There is everywhere a moderate infiltration with cells principally small lymphocytes. The vessels are everywhere engorged with blood.

*Cerebellar Cortex.*—In a few places, localized areas of cellular infiltration are seen in the molecular layer. They occur mostly in that portion of the molecular layer which borders on the granular. There is considerable edema in these areas and in a few places small hemorrhages are seen. The Purkinje cells in the neighborhood show acute cloudy swelling and in some instances more severe degenerative processes. The infiltrating cells are largely neuroglia and polyblasts. There are a few plasma cells and very few small lymphocytes or leucocytes. The granular layer and medulla appear normal except for the general vascular congestion.

### *Cerebral Hemispheres*

*Pia Mater.*—The pia is much thickened. Its vessels are much congested. There are numerous hemorrhages and much edematous swelling. On the surface and between the pial layers there is considerable fibrinous exudate. There is a diffuse cellular infiltration which is more marked than is generally seen in this region. The cells are mostly lymphocytes.

*Pallium.*—The blood vessels are dilated and congested but there is no perivascular infiltration, hemorrhage nor edema. No cellular infiltration is seen and the ganglionic cells appear normal.

CASE 16. Serial No. 517. Source, Bellevue Hospital. Material: From spinal cord.

### *Spinal Cord*

*Pia Mater.*—The blood vessels of the pia are dilated and filled with blood. Here and there small hemorrhages are seen into the pial spaces. There is considerable edema and some fibrinous exudate. In places there is a moderate infiltration of lymphocytes. This is most marked in the pial fold in the anterior spinal fissure.

*Anterior Horn.*—The branches of the anterior spinal vessels are everywhere congested. The Virchow-Robin spaces are distended and contain many cells. In some areas there are small hemorrhages. There is some edema but it is nowhere very marked. Throughout the entire gray matter there is diffuse infiltration of cells. In some areas there are localized cellular accumulations, which in many instances have direct relation to a blood vessel.

*Ganglionic Cells.*—The ganglionic cells in the anterior horns have almost entirely disappeared. There are very few scattered ones remaining and all of them show advanced, acute cloudy swelling. The disintegration has taken place without the aid of

neuronophagocytes. There is rather marked neuroglia proliferation.

*Posterior Horn.*—Here the changes are similar to those described in the anterior horn but of less severity. There is marked

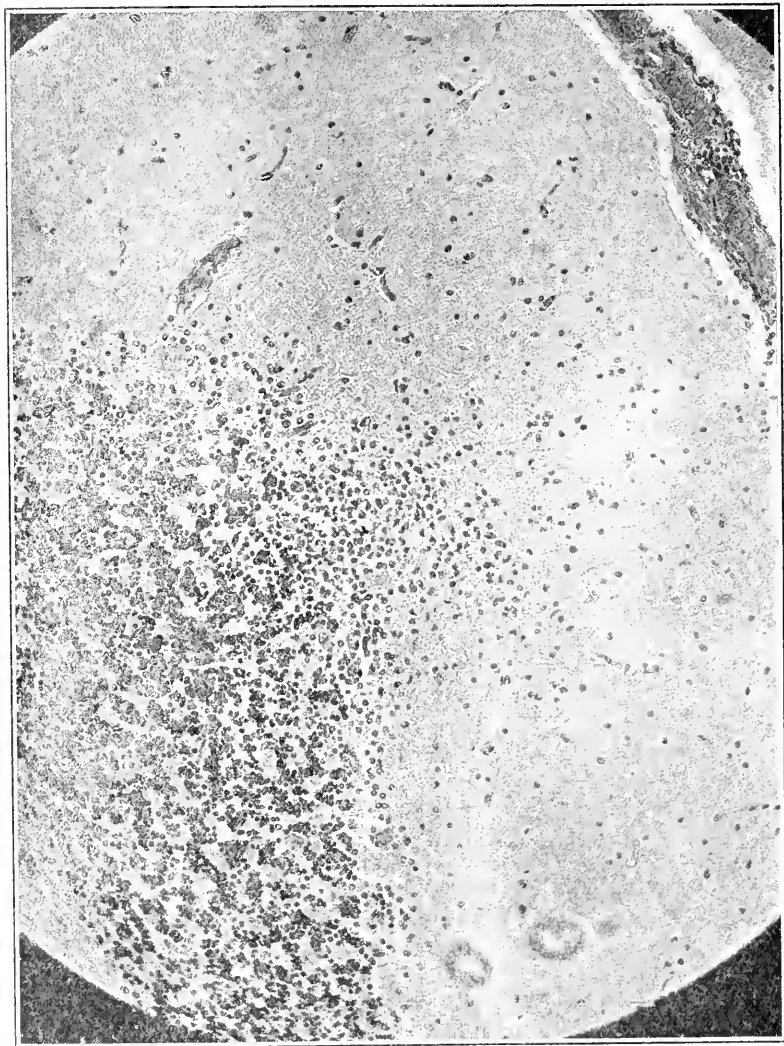


FIG. 20. Section of cerebellum. Human case No. 516.  $\times 300$ , showing type of cells in the mixed form of reaction affecting the cerebellum.

vascular congestion and perivascular infiltration, with a good deal of edema and a few small hemorrhages. As in the anterior horn the ganglionic cells have almost completely disappeared. Those

[illegible][illegible]





509	Blood Vessels	Perivascular Infiltration	Hemorrhage	Edema	Neuronal Cloudy Swelling	Neuronal Disintegration	Neuronal Disappearance	Cavitation	Neuronophagy	Types of Neuronophagyocytes	Proliferation of Neutrophils
<b>CORD: PIA.....</b>											
Anterior horn.....	Congested	None	Slight	Marked							
Posterior horn.....	Congested	Slight	None	None	None	None	None	None	None		None
White matter.....	Congested	Slight	None	None	None	None	None	None	None		None
Dorsal root ganglia.....	Congested	Slight	None	None							
<b>BRAIN STEM.....</b>											
CEREBELLAR PIA.....											
CEREBELLUM.....											
CEREBRAL PIA.....											
PALLIUM.....											
<b>510</b>											
<b>CORD: PIA.....</b>											
Anterior horn.....	Congested	None	Marked	Marked							
Posterior horn.....	Congested	Marked	Moderate	Moderate			Complete	None	None		Slight
White matter.....	Congested	Moderate	Slight	Slight			Slight	None	None		None
Dorsal root ganglia.....	Congested	Moderate	None	None							
<b>BRAIN STEM.....</b>											
CEREBELLAR PIA.....	Congested	None	Marked	Marked							
<b>CEREBELLUM.....</b>											
CEREBRAL PIA.....	Congested	None	None	None			None	None	None		None
PALLIUM.....	Congested	None	Slight	Marked			None	None	None		None
		None	None	None			None	None	None		None



[illegible][illegible]



which remain show acute cloudy swelling, but, for the most part, to a less degree than is seen in the anterior horn cells.

*White Matter.*—The white matter appears normal. Its vessels, however, are congested and show cellular infiltration of the Virchow-Robin spaces.

## PATHOLOGICAL FINDINGS IN SEVEN MONKEYS (*MACACUS RHESUS*)

### MONKEY NO. 1001

#### *Spinal Cord*

*Pia Mater.*—The blood vessels on the anterior surface of the cord are widely dilated. In this region and also between the posterior roots there is much edema. There are many small hemorrhages but practically no infiltration with white cells.

*Anterior Horn.*—The anterior horns have been nearly destroyed. The vessels are not markedly congested and there is but little infiltration of the Virchow-Robin spaces. There is a good deal of edema of the glia matrix and some proliferation of the neuroglia cells. Accumulations of lymphocytic elements are not seen anywhere.

*Ganglionic Cells.*—The ganglionic cells have almost disappeared. In a few places irregular masses of cytoplasm without nuclei are to be seen. There is no evidence of neuronophagy.

*Posterior Horn.*—The appearance of the posterior horns is somewhat similar to that of the anterior horns. The blood vessels are somewhat congested, but no perivascular infiltration is observed. There is little edema and but moderate, diffuse infiltration with cells. As in the anterior horns these cells appear to be largely of neuroglia origin.

*Ganglionic Cells.*—The ganglionic cells show a slight degree of acute cloudy swelling.

*White Matter.*—Some portions of the white matter appear edematous, especially the portions surrounding the anterior horns.

#### *Cerebral Hemispheres*

*Pia Mater.*—The pia is edematous. All the blood vessels are much dilated, and here and there small hemorrhages are seen between the layers of the pia. In some areas there is a moderate infiltration of lymphocytes.

*Pallium.*—The blood vessels of the cerebral cortex are congested. Some of them show a slight infiltration of cells in the Virchow-Robin spaces. There is no cellular infiltration of the cortex and the nerve cells everywhere appear normal.

### MONKEY NO. 1045

#### *Spinal Cord*

*Pia Mater.*—There are marked evidences of meningitis in all portions of the pia. The blood vessels are much dilated. There

are free red blood cells to be seen everywhere between the pial layers. There is much edema and a moderate infiltration of lymphocytes. Nowhere is there any fibrinous exudate.

*Anterior Horn.*—In the anterior horn one sees the blood vessels much congested, but the Virchow-Robin spaces show but slight infiltration. There are many small hemorrhages throughout the gray matter and a moderate edema of the glia matrix. The entire anterior horn is infiltrated with cells which are largely polyblasts and ameboid glia cells.

*Ganglionic Cells.*—None of the ganglionic cells appear normal. Many of them have disappeared and those which remain show severe, acute cloudy swelling. Beginning neuronophagy is very frequently to be observed. The neuronophagocytes are mainly ameboid glia cells though polyblasts and polymorphonuclear leucocytes are not absent.

*Posterior Horn.*—In the posterior horn there is also a diffuse infiltration with cells similar to that of the anterior horn and only slightly less in degree.

*Ganglionic Cells.*—Practically all the ganglionic cells of the posterior horn have disappeared. There is, however, no evidence of neuronophagy.

### *Cerebellum*

*Pia Mater.*—Except for a slight congestion of the blood vessels the pia appears normal.

*Cerebellar Substance.*—There are no changes observed in the cerebellar substance.

*Dorsal Root Ganglion.*—The nerve cells show moderate, acute cloudy swelling. There is some proliferation of the satellite cells.

### MONKEY NO. 1054

### *Spinal Cord*

*Pia Mater.*—In the pia, especially over the anterior surface and to a slightly less extent on the antero-lateral surface, one sees considerable evidence of edema. A fibrinous exudate is marked over the anterior surface of the cord and a lymphocytic infiltration is more evident in the fold of the pia which accompanies the artery of the anterior fissure. The branches of the antero-lateral and postero-lateral arteries which enter the cord show a slight yet definite infiltration of the Virchow-Robin spaces with lymphocytes and very few polymorphonuclear leucocytes. This same phenomenon is most marked in the vessel branches which arise from the anterior spinal artery. The more posterior portion of the cord the less pronounced is the vascular infiltration. In the gray matter, the anterior horn cells are all more or less affected. No normal cells are seen and at best one sees acute cloudy swelling of advanced grade with broken nuclei. In all of the nerve cells phagocytes are seen in varying numbers. From ten to twelve in the better preserved cells, to hundreds in those whose cell morphology shows nothing approaching the normal. These phagocytes consist for the most part of round

cells with homogeneous staining cytoplasm, and are probably polymorphonuclear leucocytes. The remaining phagocytes are round cells each with a single irregular nucleus containing considerable chromatin and an irregular dense network. Except for the clusters

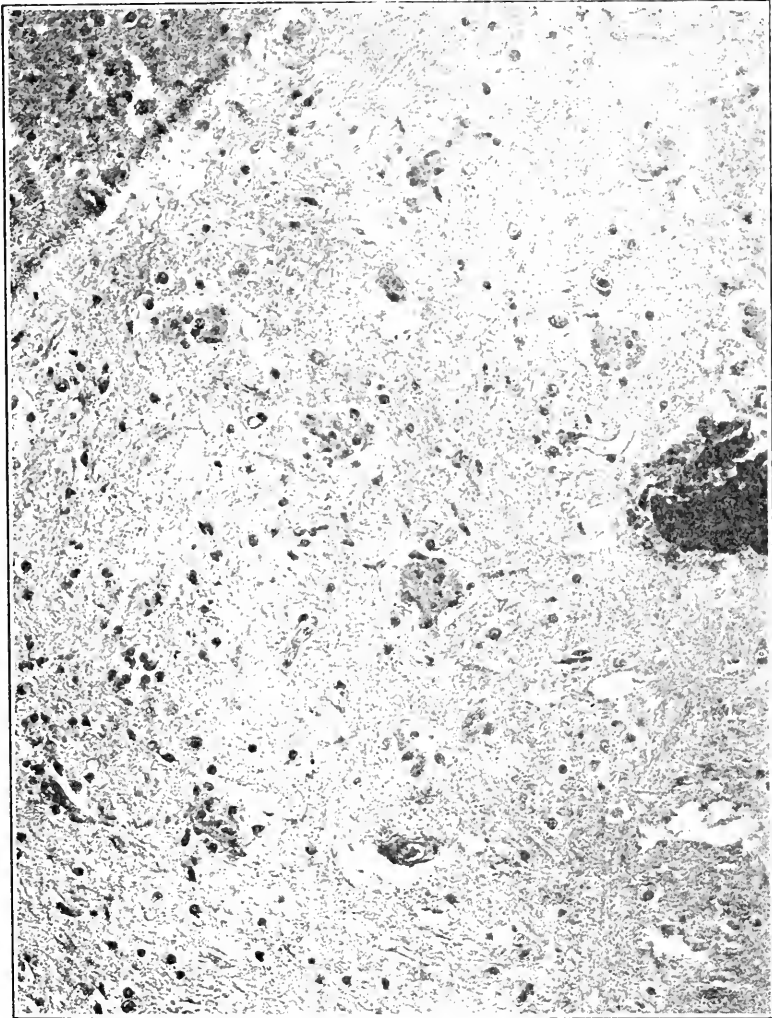


FIG. 21. Section of anterior horn of monkey 1054.  $\times 300$ . Acute cloudy swelling with moderate neuronophagy without chromatolysis.

of polyblasts and polynuclear leucocytes here in the degenerating cells, one sees a striking absence of all changes elsewhere in the gray matter. There are no massive clumps of polyblasts and lymph elements anywhere and the neuroglia cells are not increased in number.

In the posterior horns, however, one sees a rather different picture. Here all changes are much less marked and although the nerve cells show some degree of acute cloudy swelling, nevertheless, what neuronophagy exists is very slight. Seldom, if ever, are more

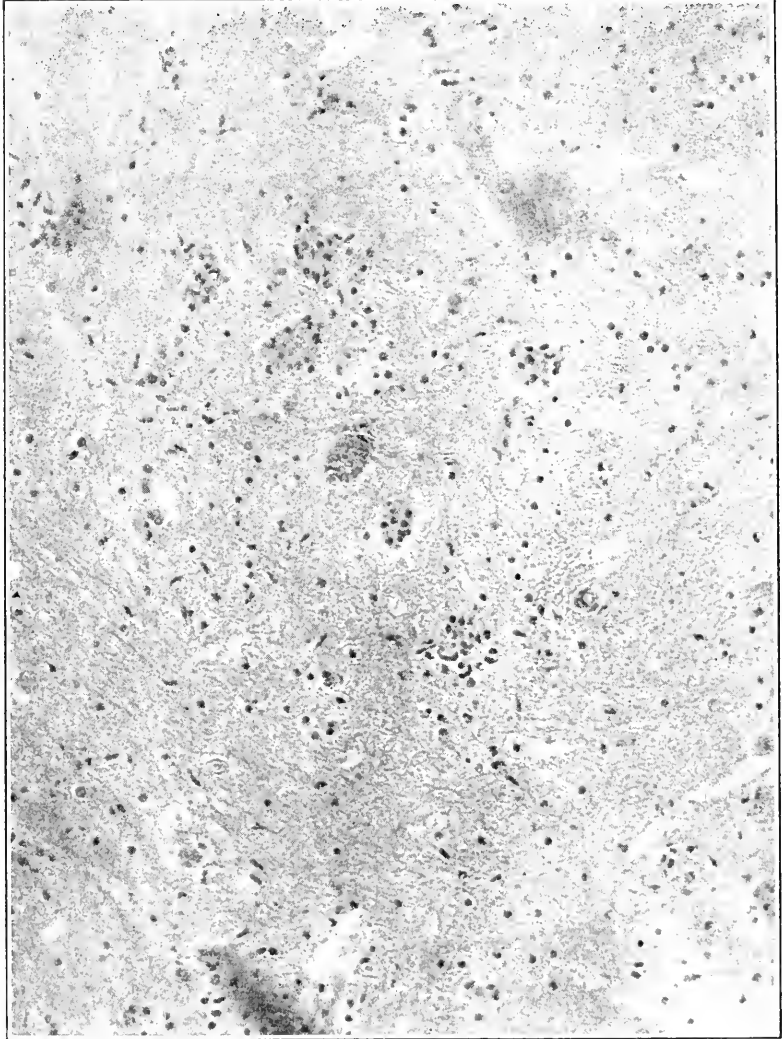


FIG. 22. Section of anterior horn of monkey 1045,  $\times 300$ , showing acute chromatolysis with moderate neuronophagy.

than two or three phagocytes seen on the cell border. These phagocytic cells are for the most part polyblasts although polynuclear leucocytes are not absent. In the posterior horns polyblasts and poly-



nuclear leucocytes are seen rather scattered in the tissue, and there is a definite, although slight, increase in neuroglia cells. The white matter appears normal.

*Medulla Oblongata.*—In the medulla oblongata one notes changes in the pia the same as were seen in the spinal cord, most marked again on the anterior surface. All the blood vessels show moderate lymphocytic infiltration in the Virchow-Robin spaces. The cells of the nucleus ambiguus show acute cloudy swelling and very rarely, here and there in the nucleus, is to be seen cell degeneration with neuronophagy exactly as described in the anterior horn cells of the cord. While the polyblasts and polymorphonuclear leucocytes appear to do the major part of "phagocytic" work, yet a considerable number of the phagocytes in this region are plainly of neuroglial origin and in those ganglionic cells where only one of two phagocytes are to be seen on the border, these latter cells are almost exclusively amoeboid glia cells. Throughout the greater part of the medulla the neuroglia cells are not increased in numbers. In places, especially in the dorsal or sensory part of the medulla, polyblasts and polymorphonuclear leucocytes are scattered throughout the tissue. In this region also there are more neuroglia cells than is normal. The cells of the hypoglossal nucleus show a slight degree of acute cloudy swelling without complete disappearance of the Nissl bodies.

### *Cerebellum*

In the cerebellum the pia shows considerable edema with some fibrinous exudate and marked hyperemia. In places fresh hemorrhage is seen in the lymph spaces. The most strikingly uniform feature is the presence in the pial lymph spaces of many cells. The majority of these are rather large lymphocytes but there exists also a large number of polymorphonuclear leucocytes and also many cells which in morphology and staining reaction correspond exactly to the polyblasts which do the phagocytic work. The cortex and white matter of the cerebellum show considerable hyperemia of the blood vessels and the latter in the cortex manifest some degree of lymph-space infiltration with the same cells which appear in the pial spaces. The nerve and neuroglia elements in the cerebellum do not show any changes.

*Cerebral Hemispheres.*—Over the cerebral cortex the pia shows hyperemia, edema and considerable fresh hemorrhage into the lymph spaces, and although cellular infiltration of the spaces with the same elements which were seen in the cerebellar pia exists, it is nowhere as marked as in the latter. Likewise, the infiltration of the cortical vessel sheaths is somewhat less marked than in the cerebellum. The pyramidal cells everywhere show acute cloudy swelling and some degree of neuronophagy may be observed scattered in the cortical layers without any regularity. Phagocytes here are exclusively neuroglial.

## MONKEY NO. 1055

*Spinal Cord*

*Pia Mater.*—There are no marked changes in the pia. The blood vessels are somewhat congested and there is some edema. In some places there are small hemorrhages. There is only slight cellular infiltration which is most evident in the anterior spinal fissure.

*Anterior Horn.*—The blood vessels are very much dilated and filled with blood. In the Virchow-Robin spaces there are many cells crowded together. Large hemorrhages are seen in many places. There is a good deal of edema, especially about the larger hemorrhages. In both anterior horns and in the commissure there is a marked diffuse infiltration of cells which latter are mainly polyblasts; some, however, seem to be lymphocytes, glia cells and leucocytes. In the anterior horns, several large localized collections of cells are seen. These cells are largely polymorphonuclear leucocytes. As far as can be determined, these cellular accumulations bear no relation to ganglionic cells or blood vessels. There is only slight neuroglial proliferation.

*Ganglionic Cells.*—The great number of anterior horn cells have disappeared. Here and there spaces are seen which appear to have contained ganglionic cells. The few cells which remain show marked degenerative changes. Some of them appear to be simply a mass of disintegrated protoplasm with no nucleus. Others are better preserved and have irregular feebly stained nuclei. No neuronophagy is seen.

*Posterior Horn.*—In the posterior horns there is some congestion of the blood vessels with moderate perivascular infiltration. There is one large hemorrhage and several small ones. Edema is not marked. There is practically no cellular infiltration.

*Ganglionic Cells.*—The cells of the Column of Clark show acute cloudy swelling as do the other posterior horn cells. There is no neuronophagy or neuroglial proliferation.

*Cerebellum*

*Pia Mater.*—The blood vessels are very much congested and there are many small hemorrhages between the pial layers. Edema is nowhere marked. There is only slight cellular infiltration. The cerebellar tissue seems normal.

*Cerebral Hemispheres*

*Pia Mater.*—The cerebral pia appears normal except for slight congestion of the blood vessels.

*Pallium.*—The blood vessels in the cerebral cortex are somewhat congested and a few of them show a slight increase in the cells in the Virchow-Robin spaces. There is no hemorrhage or edema. The nerve cells appear entirely normal.

## MONKEY NO. 1074

*Spinal Cord*

*Pia Mater.*—The pia is much swollen. There is a good deal of extravasated blood on its surface and between its layers. Fibrinous exudate is nowhere seen and there is but little cellular infiltration. The blood vessels are much congested.

*Anterior Horn.*—Most of the blood vessels in the gray matter show moderate congestion though it is not as marked as is frequently seen. The Virchow-Robin spaces show, in most instances, a single layer of cells. There is no hemorrhage and little edema. At the base of the anterior horns and also in the commissure there are two or three localized areas which are infiltrated with cells. These areas seem to bear no special relation to blood vessels or ganglionic cells. The cells are mostly polymorphonuclear leucocytes.

*Ganglionic Cells.*—The anterior horn cells appear singularly normal. They are not swollen and practically all of them show normal tigroid bodies. Apparently some of them have disappeared. There is no neuronophagy.

*Posterior Horn.*—In the posterior horns there is no evidence of vascular congestion, hemorrhage, edema or cellular infiltration. The Virchow-Robin spaces are normal. No ganglionic cell changes are observed.

*Cerebellum*

*Pia Mater.*—The blood vessels are congested and there are a few hemorrhages and moderate edema but no other evidence of meningitis.

*Cerebellar Substance.*—There is moderate congestion of the blood vessels. No hemorrhages are seen anywhere, and there is no perivascular infiltration. In one portion of the molecular layer bordering on the granular, there is an area of marked edema. The Purkinje cells in this region all show advanced acute cloudy swelling. Throughout the edematous region there is a rather dense infiltration of cells which appear to be neuroglia cells. They are identical in appearance with the neuroglia cells of the granular layer. The white matter appears normal.

*Cerebral Hemispheres*

*Pia Mater.*—As is frequently observed, there is edema and congestion of the cerebral pia but no other evidences of inflammation.

*Pallium.*—Except for slight congestion of the vessels it appears normal.

## Society Proceedings

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### THE CHICAGO NEUROLOGICAL SOCIETY

THURSDAY, FEBRUARY 21, 1918

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DR. ARTHUR W. ROGERS, President, in the Chair

#### CASE OF BRACHIAL PLEXUS PALSY

Dr. Paul F. Morf presented a boy fourteen years who entered the Cook County Hospital on January 24, 1918. Ten weeks before admission he was accidentally shot in the left shoulder. Immediately afterward the arm fell down limp and the boy thought it was shot off. There was also an immediate paralysis of the left forearm which was anesthetic from the middle of the forearm down to the fingers. There was considerable bleeding for a few minutes. No swelling was noticed, but considerable pain was present until he was operated upon about forty-eight hours after the accident. An attempt was made at that time to locate the bullet, but it was not found and the paralysis persisted. When first seen by Dr. Morf examination revealed a motor paralysis of the muscles of the forearm. The fingers were drawn down quite firmly into the palm, resembling that at the time of presentation, and there was inability to extend them. The anesthesia persisted for about six weeks and then disappeared to a considerable degree. When he entered the hospital there was the motor paralysis with considerable contracture and a small area of anesthesia at the inner side of the hand. At this time Dr. George W. Hall examined the patient and reported that the axillary nerves were involved at the lower border of the brachial plexus, as shown by paralysis and sensory disturbance. It appeared that the inner cord might be divided or caught in scar tissue, whichever condition being present might be dealt with by operation. There seemed to be an inner cord involvement. The absence of cervical sympathetic symptoms indicated that not the primary division but the secondary division of the plexus was involved.

The question as to the exact existing pathology was a matter of interesting speculation. In view of the fact that the boy had chiefly paralysis in the ulnar and median nerve, the question was whether these were both divided or whether the inner cord of the plexus was divided. The partial anesthesia of the ulnar nerve associated with a complete motor

paralysis of the ulnar nerve seemed peculiar. Another peculiarity was that there should be this nerve involvement from a gunshot wound in the axilla without any involvement of the axillary blood vessels. X-ray examination with a stereoscopic plate showed the bullet lying just in front of the second rib near its articulation with the second dorsal vertebra. In view of the findings it seemed that something should be done to restore, if possible, the function of the nerve. If it was imbedded in the scar tissue it seemed best to free the nerves from the scar tissue; if divided, to suture the divided nerve or nerves.

On January 29 an incision was made at the lower margin of the axilla, the flap dissected backward and the axillary vessels located. The pectoralis major and minor were divided in order to get a thorough access to the axilla. A very large amount of scar tissue was found which was difficult to dissect. After locating the ulnar nerve he followed it upward until he came to the mass of tissue which looked like a bunch of glands lying on the axillary artery which was distinctly raised by each pulsation. The question was whether it was really glands or whether there was an aneurysm, an eventuality which had not been considered. After further dissection it became apparent that there was an aneurysm which was about as large as an ordinary hickory nut, probably seven-eighths of an inch in diameter. He further carefully dissected out the axillary vein and tried to get at the first portion of the axillary artery, which was imbedded in the scar tissue. He made an incision above the clavicle and followed the brachial plexus down from above, afterward carefully dissecting out the portion of the axillary artery above the pectoralis minor. After a careful dissection of the first part of the axillary artery he was able to get a double ligature around it. The artery was divided between the two ligatures, whereupon he proceeded to peel out the aneurysm. Instead of having a round form it was rather flattened out and the outer cord of the plexus was found firmly adherent to the aneurysmal wall. After separating the outer cord, he dissected the aneurysm down until he got to the beginning of the third portion of the axillary artery, where the artery was tied off again and also the accessory branches. There was some tearing, but hemorrhage was controlled without difficulty. The operation lasted about three hours and on this account some infection in both wounds occurred, but this had very largely disappeared at the time of presentation. After operation he questioned himself as to whether he had found the real seat of the trouble, but his doubts were cleared up in a few days when the boy began to move his fingers and within two weeks after the operation the function was gradually improving.

The patient was to receive electric treatments and massage. Dr. Morf thought the case could be considered absolutely unique, although he had not had an opportunity to look up the literature on the subject. He cited a case of brachial plexus paralysis in a boy who had a supra-condyloid fracture of the humerus from a fall in a public playground.

He noticed considerable paralysis and thought it must be a paralysis of the fifth and sixth intraspinal nerve roots due to their having been torn out of the spinal cord. Surgery in that region was impossible, so he decided to try implantation of the posterior cord of the plexus into the outer cord. This was done without result. The boy was then removed to the children's hospital and the parents later declined any further operative interference.

Dr. George W. Hall in discussion was much interested in the result of the operation and thought the improvement was very marked. In the last case referred to the condition was produced while the boy was falling and grabbed something with his hand. In cases he had seen with a similar history the trouble had been in the lower brachial rather than the upper and in those cases the sympathetic syndrome was brought out which helped to locate the injury, but in Dr. Morf's case this was not present, as the pressure and adhesions had involved the secondary divisions of the plexus.

Dr. William Shackleton said he had seen a somewhat similar case four years ago in which a bullet entered the forearm, cutting off the ulnar. The case was operated within a day or two. The bullet passed along the nerve and it had the appearance of a nerve which was seized in artery forceps and crushed. The doctor dissected out the nerve and allowed it to remain as it was and the patient got along very nicely. Dr. Shackleton asked Dr. Morf if he had had any experience in tracing out the nerves where they were imbedded in the scar tissue. He had been called down into the state to operate in such a case and Dr. L. J. Pollock had suggested that he try out the method they were using at the Front, trying to stain the nerve sheaths with weak methylene blue. He got into a lot of adhesions and tried Dr. Pollock's suggestion and was agreeably surprised to find that the nerve sheath stained so that it was easy to trace along its course in the scar tissue.

Dr. Morf, closing, in reply to Dr. Hall's remarks regarding the second case cited said that while in most cases the injury was in the lower part of the plexus in the case described it seemed impossible for it to be in any other place than where he had described it. In reply to Dr. Shackleton's question he stated that he had had no experience with methylene blue. There were not a great many cases of nerve injury; in his surgical service of nearly seven years at the county hospital he had had only the two cases of nerve injury to operate upon. Even if a person received a gunshot wound in the region of a nerve it very often escaped injury. It seemed reasonable to believe that any method of staining the nerve would be a very great help in locating the ends that should be brought together.

## TRAUMATIC NEUROSES

Dr. Harold N. Moyer presented this paper. He expressed the belief that the term traumatic neurosis found no proper place in our nomenclature as a diagnosis. He did not wish to be understood that neuroses may not follow traumatism, but expressed the view that the symptoms, pathology, and course of these affections do not differ from neuroses from other causes. Any discussion of this subject commonly begins with a reference to the work of Erichsen, who is supposed to have coined the term spinal concussion. The credit for this, if such there be, should be given to John Abercrombie who, about one hundred years ago in his work on Diseases of the Nervous System, had a chapter on spinal concussion. Erichsen's views were formulated on no clearer conception than were Abercrombie's, but unlike the latter he proceeded to draw conclusions from limited observations which have not been borne out by the subsequent study of these cases.

The publication of Erichsen's views in 1865 started the legal ball rolling; it commercialized the personal injury business. In 1875 there were pending in the courts of Cook County about 200 personal injury cases. Twenty years later the number had grown to over 3,600 cases. Ten years after Erichsen's publication Page wrote a book in which he discussed these neuroses. In the polemics of the time he figured as a railroad surgeon and hence was thought to have written with a special bias. An examination of his contribution shows that it was based on an accurate study of 234 cases, all of which were followed for a period of from 3 to 5 years. His contribution still remains of distinct value. Later Oppenheim accurately described 42 cases of traumatism to the nervous system, the most of which did not recover. It is evident that Oppenheim's conception of traumatic neurosis was very different from that of the more modern notion, which regards anything from a twitching of an eyelid and tiredness on exertion as an expression of the effect of trauma on the nervous system. America has contributed some splendid discussions on this topic, notably Dana's paper of 1885, which was later followed by the excellent chapter in Pearce Bailey's work on Accident and Injury. Of the later contributions to this subject Schusters,' of Berlin, is one of the most lucid.

A practical difficulty that meets the neurologist in examining those who have been injured is the mixed character of the cases that reach him. Comparatively few personal injury cases consulted who present only a neurosis. There may be a fracture on which is engrafted a neurosis. There may be an injury to the spinal column with associated functional symptoms or even with symptoms that are clearly traceable to the local injury associated with them. From the standpoint of disability and prognosis these cases are of the utmost difficulty. It is these difficulties that make it so important that we should approach the individual case, without preconceived theories, as a clinical problem. Every such case

should have an accurate study, and this presupposes a painstaking and elaborate history. Obviously the inquiry should relate to the previous history of the patient, and it should be searching as to his health history; whether he had sustained an accident or suffered serious illness or impairment of health in any way. Often without direct questioning the patient's statement will reveal neuropathic antecedents. There should be a thorough inquiry into the nature of the accident. Then the story of the onset of the symptoms should be obtained. It is in this portion of the anamnesis that the malingerer betrays himself. He comes to the examiner with the purpose of claiming a pain in the back, which does not exist. All that he expects to say is that his back hurts him. When this is followed up by a series of questions as to when this symptom came on, its character, its location, and many other questions it is obvious that the man who is describing not a real pain but a fictitious one at once loses himself in an effort to answer questions which have no basis in his past experience. The same rule is to be followed regarding every other symptom such as impairment of vision, loss of hearing, vertigo, or other subjective symptoms.

There is one symptom that is elusive and difficult to estimate and that is weakness. After a most searching analysis of symptoms and careful physical examination the subject may claim that he is too weak to work, or that he gets tired on slight exertion. About two years ago my attention was directed to tests that have been employed by physical directors and a table that was compiled by Compton for recording what he has named the "blood ptosis test." It is based on a study of the alternation in pulse rate and blood pressure when lying and standing. A person who is in perfect physical condition will present a slight or no increase in the pulse rate when standing over that when lying down. The systolic blood pressure will be about ten points higher when standing up over what it is when lying down. In the percentage table which Compton has constructed the two elements of increase in the pulse rate and the lowering of the blood pressure are correlated. I believe that this test furnishes the best objective evidence of weakness and incapacity that we have. After using it for a number of years in making upwards of 500 observations, I have come to the conclusion that a man who claims physical weakness and who ranks 80 or above on Compton's scale is telling what is not true. If, however, he gives a reading approaching 50 or below, it is very strong evidence that the man is weak and incapacitated. The test is also of great value in distinguishing psychogenetic symptoms from those which have a somatic basis.

The relation of traumatism to the development of organic disease of the brain such as headache, dementia, and tabes is a most interesting problem. Many times slight traumatism seems to initiate the symptoms of these organic diseases and it is a most difficult problem to estimate the possible relation of the traumatism to the development of the symptoms. The same thing is true in relation to tuberculosis. Occasionally



we get pure types of neuroses but these are exceptional. One of the commonest is the pure type of hysteria. If the symptoms in these cases come on immediately after the trauma, it will then be found almost certain that they have had such symptoms prior to the accident. If, however, they come on two or three weeks afterwards, the symptoms then will probably bear a more definite relation to the trauma and are probably the result of post-traumatic suggestions. The neurasthenics have a more definite prognosis than the hysterical. Occasionally traumatism has a close relation to the development of early symptoms of dementia præcox.

It would seem to me that if there was still a place for traumatic neurosis it should be restricted to the sense in which Oppenheim used the term. Many of these present definite evidence of organic impairment of the nervous system and they most frequently follow severe traumatism. Many of these patients are more or less invalided for years. They constitute a small group quite easily separated from the neurasthenic and hysterical types.

Charles S. Andrus (chairman, Industrial Commission, State of Illinois) in discussion said he was not a doctor, but a lawyer, and he was rather surprised that he had been capable of understanding Dr. Moyer's remarks. He wanted to tell something about the Industrial Commission and ask a few questions about the neuroses. He stated that thirty-seven of the forty-eight states now have compensation acts, seven states having passed them last year. No state that has passed such an act has ever repealed it. On June 1, 1917, in Illinois, this act was made compulsory as to all hazardous occupations so that now every employee working in a hazardous occupation is under the act. There are about 60,000 accidents every year in Illinois. He said he had read an article by Mr. Dean, Statistician of the Ontario, Canada, Industrial Commission, who said that if there was a war every thirty years, such as is now raging in Europe, they would kill and wound about as many men as they did in industries. Compensation was paid to all men who were compelled to lose more than a week's time. In probably five per cent. of these cases there are disputes, making about three thousand cases tried by the Industrial Commission in a year. In approximately 55 or 60 per cent. of these cases medical questions were involved, and these were difficult of solution, and if the society could offer any suggestions along this line, that it would be greatly appreciated. The doctors who testified in these cases frequently did not agree, and yet they were supposed to know what was the matter after such disagreement among the doctors.

Dr. Moyer's statement about a man who was in an accident suffering from amnesia, had been of practical value to him, as he never had known it before, and it was a thing which was liable to confront them at any time. Out of two hundred cases tried by the industrial commission, selected at random, there were two of traumatic neurosis. The last case was that of a man who was injured two or three years ago. The case

went to the Supreme Court and was remanded for another trial. On the second trial here it was agreed to have the injured employee examined by three doctors, one selected by each of the parties and one by the commission. This examination was made and all three doctors agreed, something that seldom happens. He had understood that in these neurosis cases one medical authority had estimated as high as ninety per cent. recoveries when a settlement was made. That was one reason why they used to think the cases were not genuine because after a settlement was made the patient recovered.

He wished to know the opinion of those present concerning an award paid in weekly payments over a period of eight years—would the effect of this award paid in this way have the same effect as if the patient recovered the entire amount in a lump sum; also, whether after a trial compensation was denied, whether the patient would recover as soon as if he received an award. That this was a practical matter and could be remedied by legislation. If a lump sum payment would bring better results, it would be better in such cases to award a lump sum. In other words, would the patient get well quicker if he received a lump sum than if the payment was extended over several years.

He knew the doctors would be interested in the rehabilitation of injured workmen. Great work was being done along this line in Canada since the injured soldiers were returning, and they were hoping that the medical fraternity would become interested in this subject and help them, so that the rehabilitation could be extended to injured workmen as well as to injured soldiers. He understood that such a hospital was to be erected by the federal government here in Chicago, so that all the doctors should be interested in seeing this work done, not only to benefit soldiers, but also to benefit injured workmen.

Dr. H. Douglas Singer said regarding the amnesia preceding the time of the injury that he was not at all sure that Dr. Moyer was correct in making such an absolute statement. He had seen a patient on the previous day who had fallen down an elevator shaft and was unconscious for four hours. He sustained some broken ribs and a fracture of the jaw. He remembered absolutely up to the point of reaching the door of the elevator shaft but did not remember falling. He thought that sometimes the period of unconsciousness was very brief and doubted if one was justified in making such a sweeping assertion. Dr. Singer announced that the Department of Public Welfare was taking a great interest in the reconstruction work that was being planned and many people of prominence were taking an active part in it.

Dr. George W. Hall thought it would be well to keep up the reputation of disagreeing with each other and cited the case of a young man who was winding a windlass when it escaped his grasp and struck him above the eye. He was unconscious for a few moments, but he remembered the moment in which the hand left the windlass. It seemed to him that Dr. Moyer's rule had exceptions.

Dr. William Shackleton said that while listening to Dr. Moyer's paper two or three cases that had come before the industrial board came to his mind. One case was that of a man who was walking near a building that was being constructed when a crowbar fell three stories and struck him on top of the head. The man came in for examination and on going over him he could find no organic lesion. He was referred to a neurologist, who confirmed these findings. The man was incapacitated to a certain extent, but yet had absolute control of all physical and mental capacities. He thought it was not necessary to state his color.

In another case a man while winding a windlass hoisting a large machine in a factory fell and landed on the floor below, striking his head against a radiator. This man has a depressed skull fracture and a portion of the skull was removed. He came up for examination and again they found no evidence of organic lesions; he was referred to a neurologist who confirmed the findings.

In two other cases, one seen two days previously, in which the only evidence of the man ever having sustained an injury was a slight scalp wound which had healed without adhesions, the X-ray showed no evidence of skull fracture. The man complained of weakness but presented no evidence of organic lesion. The reflexes were equal on both sides. The patient was accompanied by his family physician, who maintained that inasmuch as the weakness was on the same side as the injury they should take that into consideration. The fact that the weakness and blow on the head were on the same side had no significance to the doctor. There were a great many instances of slight trauma where neurotic symptoms developed and he believed the most potent factor in such cases was "too much doctor." The neurosis came on in one of two ways—either the doctor who attended the case made a suggestion, as in the case of the man complaining of weakness, and the patient tried to bear that out and live up to his coaching, or the patient tried to develop something to prove to the doctor that he had something the matter with him.

Dr. Ralph C. Hamill stated that Dr. Moyer did not touch upon the subject of why these people develop a neurosis. What were the mechanisms that brought about a disposition on the part of the patient towards disability outside of the desire to get a reward? It seemed to him that the man's resentment against society at large, or against the thing that injured him or against his employers had to be considered. He believed this resentment was tinged with a desire to inflict punishment on someone else to compensate for the suffering he was bringing upon himself. He thought this attitude should always be considered by the physician who was trying to handle such cases. Those people were usually rather inferior mentally and if it is necessary to have that inferior class of people at work he thought it was desirable for society to recognize them in some way and award them for the risks that they have to run in their occupations. He believed there was a slight tendency to misjudge the individual who had suffered a traumatic neurosis, and did not

think we were justified in saying that such a person was merely a malingerer. He was a malingerer because he was inferior mentally and was kept at a job of that sort because he was mentally inferior. If that was true then society owed him something.

Dr. A. B. Yudelsohn said in response to the question of Mr. Andrus as to whether there could be better results if the individual was paid a lump sum, or was paid by the present method of the industrial board, that this question had occurred to him several years ago in connection with two patients he had seen at the clinic who seemed to be hopeless. Each time they appeared they would remind him of the fact that they had families on their hands and no hope of compensation. Such people now, under the present plan, had a sense of security. He was now following up two other cases and they did not seem to be so worried. Most of the working men know about the compensation act, and the fact that the unions pay so much a week, and the fact that the industrial board will consider his case, so that there was a little money coming in from time to time gave them a sense of security that justice would be done. He believed the phobia that came with the fear of subsequent disability was much less than it formerly was.

Dr. Moyer in closing said he was gratified at some of the questions that had been asked. Regarding unconsciousness, he had stated that where the effect of the blow was to produce immediate unconsciousness he had never seen a case in which there was not a retrograde amnesia. This symptom is a most valuable one in distinguishing concussion cases from those in which there was edema of the brain which resulted in unconsciousness. He had investigated this point with very great care in every case where it was possible to obtain an accurate history of the circumstances attending the injury. In cases of loss of consciousness which follow after an injury which might properly be called secondary, this retrograde amnesia is not present. Where the loss of consciousness is immediate as a result of concussion there is always a retrograde amnesia. The mental attitude of these patients brought out by Dr. Hamill in his usually felicitous style was quite in line with his views. The mental attitude of the physician toward these patients was most important. It should always be sympathetic, especially if one has an idea that the patient is trying to deceive him. It is difficult to say how much suggestion has to do with these cases. It is of undoubtedly very great effect. The physician does not mean to have this act in this way, but a grave face when examining the spine, a suggestion that there is a fracture of the back, or a broken skull is sufficient to upset many who are not especially suggestible.

He thought Mr. Andrus had asked a very difficult question in regard to compensation, whether to give a lump sum or weekly payments. He was inclined to think that the lump sum and getting the case out of the way was a better way of dealing with it. This, however, would be an opinion based on the medical side; from the administrative point it might be advantageous to have it reversed.

He regretted that he had not been often before the industrial board, but judging from the few times when he had been there he was impressed with the judiciousness of their inquiries and the evident desire to get at the facts. There was a freedom from ordinary limits of court procedure which was most satisfactory. The board made an effort to get at the facts and he believed that that much abused term "substantial justice" was reached in their procedure.

# Critical Digest and Review

## WAR NEUROSES AND PSYCHONEUROSES

BY DRS. CHAS. R. PAYNE AND SMITH ELY JELLIFFE

### INTRODUCTION

Superlatives in regard to the character of the war or the unprecedented opportunities it presents tend to fall away. Thought and effort have learned to accustom themselves somewhat to the unique measurement of the conflict, and are being brought more and more to the utmost effectiveness of directed attack in every department of national and international service. It is our purpose therefore to review the situation as it has already presented itself and as it continues to record progress in the particular medical field represented by neurology and psychiatry. Particular attention will be given where experience itself has revealed so large a sphere for psychiatric interest, that of the psychoneuroses. Out of this most extensive laboratory which the war has opened up and from the need of the many who are disabled through these disorders alone, arises a vast opportunity and a vast responsibility directly toward war service and indirectly toward the neuro-psychiatry of the future.

Modern interest in psychiatric and neurological problems arising out of war injuries and through the strain of modern war conditions received great impetus and made some signal advance during the Russo-Japanese war. That conflict awakened keen interest in the actuality and the diversity of such problems as part of medical service and investigation. Besides there existed at that time something of the intensity and high development of modern fighting methods with their manifold refinements of destructive agencies and also the strain and stress attendant upon such development. The present war has, however, far outshadowed that conflict. The length of time of individual battles and campaigns at that time, as of the whole war, was as nothing in the face of the unending and unyielding pouring of foe against foe, which for want of a suitable term yet evolved we continue to call battles. Moreover the multiplication of injuries in diversity and in destructive character has

more than kept pace with the advance of science in these few intervening years. And the nervous system and the mental make-up of the individual soldier has had to bear its full share of the result.

There is then a call for every resource of mental and neurological understanding and therapy. Neurological surgery has met its opportunity and not only adapted itself to its task of mending and healing but has thereby enriched its knowledge and skill as no amount of operative work upon the traumatic and diseased conditions presented in ordinary times of peace could ever have permitted. The ruthless projectiles, devised to destroy to the uttermost, have no concern for the location or the form of an injury, its completeness or an incompleteness which produces far more dangerous and complicated wounds than surgery has had to deal with before. Brain, spinal cord and peripheral nerves have been victims of the caprices of the splintered projectiles, which add their peculiar destructiveness to the overwhelming force with which they are hurled. Infection has thus entered to further multiply the complexity and the complications of the injuries, while explosions, gas poisoning, interment under masses of earth or other débris have produced actual local injury to the central and peripheral nervous systems aside from the mental shock with its psychic train of manifestations.

There has thus been afforded opportunity for work upon injury of every kind and every extent in brain and spinal cord, infective processes of varying degree, some most serious and complicated, all of which has led to greatly increased knowledge of the injuries possible to these tissues and to skill and surety in dealing with them. Such knowledge and experience necessarily radiate to related conditions of infection and injury which would arise in ordinary life. How far such processes can extend and what is the nature of their results is thus very extensively brought to light. Furthermore, here as in other war surgery there is little time or opportunity for hesitancy. Conditions are extreme and must be decisively dealt with. As it has been noted in connection with other wounds, operations must be undertaken which would either not present themselves at all in civilian practice, or surgery must simply go ahead here where the issue is brought sternly to life or death and where there is also an added urgency to restore the soldier if possible to activity. Surgery is therefore more directly productive of clinical experience not only but of such definite results which follow naturally upon this character of work. New adaptations of surgery, new appliances and methods must be developed to meet the

need and to follow out the extensive work which these injuries lay before the neurological surgeon and new devices must be found and tried for restoring function and assisting the injured part to regain health and usefulness.

Serotherapy in cerebrospinal meningitis has received very marked attention and made definite advance in clinical practice. Here too it has been necessary to combat urgent conditions and to adopt a bold and unhesitating policy, which has produced striking clinical results and forwarded the knowledge and application of this form of treatment, which promises so much for the future.

The same widespread manifestation of symptoms as that met in the more definite operative surgery upon the brain and spinal cord is observable in the functional organic disturbances of the nervous system, such as in disturbances in the reflexes or those manifest in the vasomotor system, secretory system, or other systems controlled by the sympathetic and autonomic nerves. These afford the same opportunity to add to knowledge and experience in dealing with injuries affecting the portions of the nervous system dealing with these functions. At the same time they bring us nearer to understanding the interaction of the various parts of the nervous system and furthermore the close relationship of psychical condition and psychical impulse to these various branches and divisions of the nervous mechanism. Here of course lies one of the difficult distinctions to be made in diagnosis and in treatment, the separation of purely functional disorders only psychically conditioned from those due entirely, in the first place, or to a greater or less extent dependent upon organic injury to brain, spinal cord or peripheral nerves. Close similarity of symptoms often require most careful diagnostic watchfulness to distinguish psychogenic disorder from perhaps most serious somatic disease.

This opens the way into that vastly larger field much less definite of entrance and control in some respects than that of the more precise somatic injuries. Yet experience proves that in number of patients and variety of symptomatology, it forms a field of interest and opportunity for directed effort second in importance to no other department of medical service. Not always the severity of the mental disorder manifested, as compared, for example, with a disabling wound, but its obscurity, its protracted effect upon the individual, its resistance to amelioration or cure render it of most serious import. It retires too many otherwise able-bodied men from the firing line, it crowds the hospitals or burdens transportation facilities, beside rendering the individual useless to himself and even



perhaps in his home surroundings should he be returned there, and causing him any amount of that peculiar distressful suffering which belongs to these various psychoneurotic conditions. In short, it is a source of extensive loss and distress and would, unchecked and untreated, result in a depletion of the military forces and a lowering of the military morale. There is therefore the most urgent need to center attention upon the psychoneuroses of the war and rescue this otherwise wasted material again for service and to avoid the possible permanent psychical deterioration of the men. This has been recognized as a field of preëminent importance and intensive studies have been made upon it and very definite therapeutic work has been attempted.

One feature which this war is bringing very prominently to the fore in just this territory is one that has been intimated above. This prevalence of psychoneurotic developments peculiarly attendant upon the form of present warfare, all loosely comprehended under "shell-shock," the incapacitating of men from service often permanently or for an extended length of time, have laid upon the psychiatrist most unavoidably the necessity of getting the patient well and getting him back to his place at the front. This has emphasized the fact that psychic difficulties are curable, that there must be some remedy for them. Necessity says that there shall be, that if no way exists it must be found. It calls upon every reasonable form of psychotherapy to bend to the uttermost and discover the actual cause of the patient's disability and how this disability may be successfully met. It has called for such definite application to the study not only of the mental conditions which become manifest in these disturbances but of the factors which lie also behind the breakdown. These may be immediate, in the conditions of warfare aside from the actual incident of interment, explosion, striking of the projectile or whatever may have been the final precipitating cause. They exist in the conditions of warfare productive of fatigue, excessive strain, or other predisposing factors, or they may lie still deeper in the makeup of the individual, brought to the surface under these exceptional circumstances. At any rate military authorities and the entire urgency of the situation will admit no longer of the idea that the psychically diseased is necessarily and permanently outcast from the ordinarily healthy community, left to get along as best he may, granted at the most a certain amount of indulgence and supportive advice and sympathy. He has now to be cured. His psychic ills must become as definite and tangible, even though in quite a different manner, as his physically fractured thigh or dis-

located shoulder or wrenched ligaments. This is particularly true also because so many of these mental disablements are the result only of these war conditions upon an otherwise healthy background.

Thus has war made the whole problem of the psychoneuroses, including also the psychoses, a much more direct and determinate one. This attack upon them because of the exigencies of military service as well as of the general problem of the health and usefulness of these men for the future, immediate and after the war, brings its results back to civil life. Advance is made possible in the field of organic nervous conditions, in knowledge of nervous injury and disease and in increasing skill and assurance in its treatment. Just so the as yet scarcely explored field of the psychoneuroses must in the end profit enormously by these determined excursions into it and the interest in its problems which has at last been so widely awakened.

For in one sense the war has presented no new problems in this realm. We have been far too blind to the extent and the reality of the psychoneuroses in our midst, and to the more definite ways of reaching them through actually understanding their causation and their logical development out of these causes. There has therefore been little effective therapy through such understanding. The psychoneuroses of the war are not new in themselves. They too represent the same human foundation of ability or inability to react to life's difficulties and life's demands, upon which foundation the various symptoms manifest themselves according to each individual character, development, trend, measured by individual adaptive and resisting power. These are also played upon by external conditions, which present unusual difficulties or increase those already present. This war has presented many such cases and in exceptional form. Moreover in the face of the stoutest resisting and adaptive ability, it continues these conditions and keeps the victim indefinitely in the face of such conditions until fatigue gets in its insidious work or the prolonged strain is suddenly brought to the breaking point by the catastrophe of a shell wound, or burial and suffocation, perhaps with a violent precipitation into unconsciousness.

Though there are no new forms of psychic disturbances there are these causes of many varieties, which do not exist in times of peace, when often a latent psychoneurotic disposition is not brought to the test and the danger of such a breakdown has been quite obscured. These special and very trying situations produce sometimes marked psychoses but often of a curable nature, because they

represent only inability to adjust to such extraordinary demands and conditions and to withstand their constant pressure. It is so also with the psychoneuroses many times. They too represent not a chronic non-adaptability and non-resistance, even a latent one, but rather failure only temporary and more easily readjustable, to withstand in the face of cumulatively trying conditions.

None the less but so much more is it incumbent that there shall be very careful psychic testing and examination in the selection and passing of men for active service, that these latent psychoneurotic individuals shall not slip through and offer all too ready material for breakdown. This too necessitates a clarification of knowledge concerning these disorders. Their prevalence in the population must be discerned, the tendencies and traits which signify their latent presence. They must be handled as a definite factor in the preliminary examinations and passing of troops, even as in the medical practice among the disabled in the army abroad. For this reason the knowledge acquired there and the experience gained in definite therapeutic work both there and as it shall be followed up in our return hospitals in this country, is of the utmost importance as a sifting measure for our medical examiners. It ought also to tend to a psychic prophylaxis. Perhaps something could be done in our training camps to establish a better psychic adaptability and an increased resistance power. Of course all the physical training tends to that, but reports prove that it has not always been well regulated to that end. It has sometimes tended in just the opposite direction. There should be possible here a better coöperative understanding and effort of psychiatric and physical training interests, while there might also profitably be added some definite psychic training or instruction which would better prepare the men in psychic endurance. How far this may tend to the lessening or elimination of neuroses as the war progresses is worthy of careful study and practical consideration. This alone would form an important reason for considering well what has been done in this medical field of the war.

Since the whole question resolves itself to one of the most important issues in the conservation policy of our Government and its Allies, the measure of progress already made in the field of these disorders, the lessons which experience so far has taught, which daily contact with these cases in all stages of their progress, including their reaction to treatment, all these are well worth detailed review. It is in fact imperative that they should occupy a conspicuous place in our study and should be more forcibly brought to general atten-

tion. This task most fittingly includes a careful consideration of the extensive literature from the medical officers among the Allies, as well as from those of our own service who have assisted them or have themselves established departments of service.

Throughout the war, now nearly four years, neurological and psychiatric subjects and experience have received varied and extensive treatment. Some writers have occupied themselves chiefly in their reports and discussions with the organic phase of these disorders, surgical injuries or more functional manifestations, others have more exclusively written of the psychoneuroses and the attempts to treat them. Various forms of therapy have been adopted fitted to the individual needs of the cases which present themselves and the special conditions under which the various troubles became manifest. These therapeutic attempts are likewise modified by the severity of the manifestations and the likelihood of early return or not to the front, and so on. It has been most interesting and promising to note the actual effort to understand in its broadest significance the whole psychic content and attitude of the individual as the basis for proper understanding and treatment of the disordered condition. The psychiatric mind has been much enlarged to realize more clearly and comprehensively than ever before the existence of an inner problem aroused or produced by the events and dependent on the reactions leading up to the final disability. There has been a tendency to lay aside narrower classifications and limited acceptance of causes and to look into the individual as a sum of complexes, all of which tend toward any external manifested reaction. That the chief of these may be in any one case the overwhelming condition which has brought the psychoneurosis or the psychosis into play does not prevent consideration of the complete psychic setting and the basing of therapy upon such a wider view.

Nevertheless the problem of neurological and psychiatric understanding and treatment of these special injuries and disabilities is by no means a unified one. Especially is this so in the more puzzling and vaguer field of the psychoneuroses. There are many points of view and diverse methods of attack. And still the importance of the subject increases from the point of view of military efficiency, of humanity's appeal to stem and turn back the tide of this peculiar form of suffering, and for the sake of improvement in knowledge and practice in these important territories in civil life. For these reasons we purpose to follow out this growing amount of

literature and bring together in some comprehensive form the lessons which have been learned and are being learned. Our desire is to follow the active workers at the front or in the hospitals behind the lines, as new tasks are set and their solution is attempted and attained only to give place to new problems and opportunities for greater light and surer experience.

*(To be continued)*

## Current Literature

### I. VEGETATIVE NEUROLOGY

#### 2. ENDOCRINOPATHIES.

**Madigan, J. J., Moore, T. V.** DYSTROPHIA ADIPOSEGENITALIS. [The Journal A. M. A., March 9, 1918.]

A case of dystrophia adiposogenitalis, with a morbid material heredity on the mother's side, is here reported of a child who was never able to see, was very fat, and also decidedly feminine in appearance though a boy. The X-ray showed that the sella turcica was deformed, suggesting a tumor of the hypophysis beginning in the sella and destroying, by pressure, the posterior clinoid processes. Such symptoms as overgrowth, being feminine in appearance, a lack of hair with the exception of that on the scalp, and smooth, delicate skin, show that the pituitary is involved. Cushing's studies make it evident that frequently the cause of the dystrophy is due to changes in this gland. There are a few cases that are prenatal. The author gives some reasons as to why this is possibly one of them. First, the number of deformities in the mother's paternal relatives, and by the appearance of a cerebral defect on one of her paternal relatives who married a man of doubtful ancestry, all of which suggests a Mendelian recessive. Second, the origin of the case is prenatal. The reasons given are: the parents say that the child never saw; the father noticed the movement of the eyeballs when the child was only three or four months old; also the fact that the genital aplasia is such that it must date back into the prenatal history of the child, and the very small optic disks.

**Rogers, J., Coombs, H. C., Rohe, J. M.** EFFECT OF ORGAN EXTRACTS ON VOLUNTARY MUSCLE. [Am. J. Phys., Jan., 1918.]

The vigor of contraction of fatigued voluntary muscle is increased by intravenous infection of the noncoagulable portions of the alkaline saline extracts of the thyroid, parathyroid and suprarenal glands. A similar stimulant effect is shown by the commercial 1:1,000 solution of epinephrin. No other materials which are obtained from the thyroid, parathyroid and suprarenal gland show any effect of increased action on fatigued voluntary muscle. Voluntary muscle contraction is not effected by materials from the other endocrine glands. The activity of the thyroid is lessened or destroyed by evaporation. Removal of part of the thyroid seems to have no direct effect on conditions causing fatigue of voluntary muscle. "Residues" made from adenomatous thyroid ma-

terial, and also those made from the symptoms produced by overactivity of the thyroid gland, are sluggish.

**Kirmisson, E.** PITUITARY EXTRACT IN BOWEL PARALYSIS FOLLOWING APPENDECTOMY. [Bulletin de l'Académie de médecine, January 29, 1918.]

Good results from pituitary extract in the cases of intestinal paralysis frequently following operations for acute appendicitis in the presence of general peritonitis are here reported. In some of these cases intestinal paralysis is the only manifestation of the peritoneal inflammation, and at times the impression arises that the patient's life could be saved if only the intestinal paralysis were overcome. In a case of gangrenous appendicitis in a child of ten years, with marked abdominal distention and absence of bowel movements for six days after the operation in spite of gastric lavage, enemas, and castor oil suppositories, a first subcutaneous injection of one mil of pituitary extract brought colicky pains and a small stool within fifteen minutes. Further injections on subsequent days were promptly followed by increasingly copious bowel movements, and recovery took place.

**Kirmisson, E.** THYROID, COXA VARA AND OBESITY. [Bulletin de l'Académie de médecine, March 5, 1918.]

Under the term coxa vara the author includes two abnormalities, viz., a special morbid posture of the lower extremity characterized by a combination of external rotation with adduction, and a sagging of the femoral neck, which forms a right or acute angle with the shaft of the femur. Thus defined, coxa vara occurs under two different conditions: in young children, in whom it is generally accompanied by the other customary signs of rickets, and in adolescence, when, as in the case of the other skeletal deformities met with at that time, it usually occurs alone. As regards the cause of the adolescent type of coxa vara, the author was struck some years ago by the observation of a family in which three children had coxa vara and were all obese. The mother likewise suffered from obesity. Numerous cases since met with have convinced him of a close relationship between obesity and not alone coxa vara, but also epiphyseal separation at the upper end of the femur and the local disturbance which leads to "fruste" coxalgia. The three latter conditions, moreover, are themselves allied, sometimes occurring in association in several members of the same family. Thyroid insufficiency is probably the cause of the obesity underlying these conditions. The thyroid gland seemed hypoplastic in the author's cases, and the pasty features and facial puffiness suggested myxedema. X-ray examinations for pituitary enlargement in two cases were negative. In a male patient aged sixteen the genitals seemed underdeveloped, and in a girl of twelve, 1.53 meters tall and weighing 61 kilograms, menstruation had not yet appeared. Treatment by mechanical extension and thyroid gland internally yielded some benefit.

**Guemes, A.** HYPERNEPHROMA AND VIRILISM. [*Semana Medica*, Aug. 23, 1917.]

The case produced by this author by photograph shows graphically the result of a hypernephroma in the cortex of the right suprarenal. The effect of this had been to change a young woman of pleasing appearance to what was apparently a bald and heavily bearded man of 50. The microscopic findings in the case, revealed by necropsy, were sclerous atrophy of the ovary, an adenoma in the thyroid and considerable atrophy of the pancreas. This case presents a warning not to neglect investigation of the suprarenals in the evidence of pronounced virilism, when proper measures may prevent final irremediable lesions.

**Bandler, Samuel Wyllis.** DUCTLESS GLAND THERAPY IN GYNECOLOGY AND OBSTETRICS. [*International Journal of Surgery*, January, 1918.]

Bandler regards hyposecretion of the thyroid as the condition most readily overcome by the administration of the proper gland extract. For avoiding or diminishing flashes ovarian extract and corpus luteum are of great value. There are some cases, probably pluriglandular in origin, which are not benefited by this method of treatment. If the ovary is underactive and the primary condition rests there are obtained excellent results by the use of corpus luteum or, particularly, ovarian extract. Relative amenorrhea or late development of menstruation in young girls is benefited by the administration of thyroid extract and pituitrin combined with ovarine or corpus luteum. Cases of diminished menstruation and sterility are best treated by the administration of ovarian extract, thyroid extract, and pituitrin, five minims three times weekly, by hypopituitary gland extract. They should also receive corpus luteum extract and pituitrin, five minims three times weekly, by hypodermic. In conditions marked by asthenia, adrenalin hypodermically and especially the suprarenal extract by mouth, administered with the whole gland of the pituitary, for weeks and months, will often bring about good results. For uterine bleeding not due to the presence of a new growth in the uterus nor to overgrowth of the endometrium, mammary gland extract and thymus extract are excellent. Little can be expected of mammary gland extract given in large doses for fibroids of the uterus.

**Levy, R. L.** THYROID AND VAGUS. [*Arch. Int. Med.*, Feb., 1918.]

A uniform series of responses, both in degree of depressor effect and duration of cardiac inhibition results from repeated stimulation of either vagus with a given stimulus strength. This was obtained in cats pithed to the midthorax. But if the thyroid gland is induced to secretory activity, even when there is evidence that there has already been an outpouring of thyroid secretion, both the depressor effect and the duration of cardiac inhibition show no further significant alteration. It is evident therefore that there can no longer be produced a demonstrable



effect on the excitability of the endings of the cardiac vagus, after a sufficient amount of thyroid secretion has been liberated to sensitize the sympathetic structures which are acted upon by epinephrin in raising arterial pressure.

**Hunziker, H.** CAUSE AND PREVENTION OF GOITER. [Corresp. f. Schw. Aerzte, Feb. 23, 1918.]

After his study of goiter prevalent in different parts of Switzerland, the data he gives seems to carry out his theory that goiter is a functional overgrowth of the thyroid caused by the effort of the organism to make up a shortage in the iodine supply. Since iodine naturally is supplied to the food, goiter prevails in places where there is a deficiency of iodine in the vegetation. In places where goiter is prevalent, iodine-containing manure might supply the plants with the necessary iodine, and thus entirely destroy goiter. The principal goiter regions are found at a moderate altitude, from 600 to 1,000 meters; above or below this, goiter is not so common. The cooking salt used in one comparatively exempt district contained an unusual amount of iodine. Goiters develop in certain years more than in others, which fact may be due to rains washing the salts out of the soil. A sandy soil yields up salts more readily. The plants do not grow as abundantly in a rainy season, and do not take up as much of the salts in the soil. At an altitude above 1,000 meters, vegetation grows so abundantly that it works deep into the soil and takes up the salts. It is noticed that in the comparatively exempt districts, the rainfall occurs in the autumn, instead of in the spring as it does in other places. The conclusion is reached that goiter is an adaptation to a diet in which there is very little iodine. Lack of iodine in plants is what connects goiter with climate and geological formations. An easy way to remedy the lack of iodine would be to have salt made with a small amount of iodine added. Hunziker suggests that it would be well to investigate as to whether the heat of the baking would not cause the iodine in salt in bread to be volatilized. A year of "fertilizing people on a large scale by adding iodine to the salt would help to solve the problem. There is a still simpler plan, and that would be to have the salt taken from the salt springs in the district of Waadt which is comparatively exempt, and sent to a place where goiter is very prevalent and exchange it for the salt made from the springs in the latter district, that have a deficiency of iodine. All the testimony and arguments given point to the fact that a greater amount of iodine should be supplied in districts where goiter is prevalent.

**Aub, J. C., Stern, N. S.** THYROID EXTRACT AND HEART BLOCK. [Arch. of Int. Med., Jan., 1918.]

The experience which these authors report with administration of thyroid extract points to the fact that thyroid does not increase the heart beat by direct action on the muscle but through the nerve pathways. The extract was administered in increasing doses until at the end of

three or four months over 2,000 grains had been administered. The dosage had reached as high as 28 grains a day. There had been as a result an increase of 47 per cent. above normal in the basal metabolism, which fell again to normal twelve days after withdrawal of the extract. There was also a rapid auricular rate of 120 but no ventricular change. The auricular rate had returned to normal by the nineteenth day after treatment was stopped. Body weight after withdrawal increased over eight pounds. The respiratory quotient and the blood sugar remained unchanged.

## II. SENSORI-MOTOR NEUROLOGY

### 2. BRAIN AND MENINGES.

**Mink, O. J.** MENINGOCOCCUS CARRIERS. [Editorial, J. A. M. A.]

There have been approximately 1,500 cases of meningitis since last summer among our troops assembled in the various army encampments. This is a much higher rate of incidence than has existed in any civilian population of similar size in this country during this period. In Chicago during the whole year 1917 only 354 cases were reported, and this was an incidence three times as high as in 1916. Even if there were no European experience to guide us, therefore, we should have convincing evidence of the special prevalence of meningitis among the new recruits in military organizations.

Nearly all observers of the epidemiology of meningitis have laid great stress on the rôle of meningococcus carriers in spreading infection. The *Journal* has previously discussed various aspects of this question. Under the acid test of practical experience, new views about the significance of carriers and about the methods of practical procedure are finding expression. From the administrative standpoint probably the most important of these differences concerns the measures that should be taken for control in the army organization. Two quite divergent opinions have found advocates: one, that it is desirable and practicable to examine all the troops in an encampment, to eliminate all or most of the carriers and thus stop or greatly limit the spread of infection; the other, that the search for carriers is of doubtful value, and if pushed to its logical conclusion would seriously cripple military efficiency. The latter view has been especially expressed as the result of experience at the Great Lakes Naval Training Station.

The difference in these two views with their momentous practical corollaries is so great as to require serious consideration at this time. If it is true, to quote the report of Mink, that "measures to control the disease through the carrier method are absolutely worthless," then preventive measures should be based on the elimination of predisposing causes rather than on sources of infection. No one questions the great influence of inadequate clothing, improper housing and possibly fatigue in increasing the susceptibility to cerebrospinal fever among troops; but

there is abundant evidence that these are not the only factors that facilitate infection. It is a common observation that within the same military organization certain units are stricken much more severely than others under substantially similar conditions of housing and weather. When meningitis is studied by the spot map method, definite foci of infection will often be distinguished, and these foci are at points where no material differences in predisposing influences can be detected. The explanation usually given for the development of these meningitis foci at certain points and not at others is that meningococcus carriers are particularly numerous or particularly dangerous at the affected localities. Many bacteriologic observations in this country and abroad support this view. It is rather suggestive that no specific interpretation of meningitis foci based on differences in the action of predisposing factors has been established. It is also true that so-called seasoning or hardening influences are not universally effective in modifying the occurrence of meningitis. Foster and Gaskell point out that the epidemic of meningitis among the British troops in the spring of 1915 occurred when the troops were living under conditions considerably better than in the preceding autumn, and when they had become more acclimatized to their new mode of life. The same observers draw attention to the fact that there is no direct connection between a severe winter and an outbreak of cerebrospinal fever, some of the most severe epidemics in England having occurred with a mild winter. Rolleston also gives figures showing that there were more cases in the personnel of the British navy in the third year of the war (143) than in the second (104), although there were fewer in the second than in the first (170), and he adds that "the absolute rise of the naval cases during the third year of the war corresponds with a rise in the number of cases in the civil and military population, and also with an increased percentage of carriers in the navy." Perhaps the most significant fact of all, however, is the one to which we have already referred, namely, the very definite localization of meningitis cases in army camps on some basis other than that of predisposing factors. Without underestimating in any degree the importance of predisposing influences in this infection, we are forced to regard them as only one element in the situation. Causes that affect individual susceptibility cannot be ignored in the practical control of meningitis; but we are not justified on that account in neglecting other measures of combating meningitis dissemination.

Probably the real issue is not so much the importance of meningococcus carriers as the practicability of segregating carriers while at the same time maintaining a reasonable degree of military efficiency. It will be generally admitted that more specific evidence is needed respecting the results actually accomplished by meningococcus carrier work in the army camps. At the same time some of the criticisms of the effectiveness of this work are themselves of questionable cogency. In making comparisons of carrier conditions, the number of carriers in a unit is

only one factor; we should also know the proportion of chronic carriers (probably the more dangerous type), the proportion of new recruits in the units that are compared, and the possible influence of overcrowding and other living conditions, as well as the period of time over which observations extend. It must not be forgotten that the examination of healthy persons in a locality where meningitis does not prevail and there is no obvious association with cases of the disease has shown the relative absence of carriers. One obvious difficulty in the way of satisfactory comparison is the evaluation of the relative efficiency of the methods of meningococcus isolation and identification in the hands of different investigators. The use of fairly uniform methods embodying the results of the latest experiences in this field would be a step in advance.

Respecting the feasibility of making meningococcus carrier examinations, and utilizing the results under military conditions, we have quite a body of experience to draw on. It is rarely, if ever, that the examination of a large body of troops—say a division—will justify itself on grounds either of adaptation to the military situation or of control of epidemic spread. It is never possible to obtain absolute segregation of the military population from the surrounding civilians, or of the various units of the military group one from the other. The result is that new carriers are being more or less steadily created or introduced while the work is going on. The labors of Sisyphus were small in comparison with the attempt to find and segregate all the meningococcus carriers in an assemblage of 35,000 men.

It seems probable that the most useful practical procedure lies somewhere between the extremes of universal nasopharyngeal examination and no examination at all. If those soldiers who have been in close association with the one attacked by meningitis are examined, it is often found that one and possibly more of these "healthy contacts" is a carrier of large numbers of meningococci. Authenticated instances have been recorded in which the isolation of such a carrier has been followed by the cessation of meningitis in his organization. The inference also seems warranted that the failure to remove such a carrier early in his career is responsible for the development of the striking and characteristic meningitis foci already mentioned.

From the army standpoint it seems likely that the procedure here indicated can be carried out without undue interference with essential military needs. Prompt segregation of ten or twenty or more immediate contacts until the bacterial results are obtainable—say for a period of forty-eight hours—and isolation of the carriers found, only one or two of whom may prove to be chronic carriers, are not measures likely to produce serious disorganization of the camp activities. There is reason to believe that they will aid materially in preventing the development of meningitis foci. It goes without saying that there are military situations, as at an embarkation port, where even this measure of control can

hardly be carried out. It will also be granted that a more comprehensive examination would show the presence of meningococcus carriers in troop units in which no case of meningitis had developed and did not develop through a long period of observation. Such carriers, however, evidently do not possess the urgent practical importance attaching to those carriers in the immediate vicinity of a case of meningitis. In a word, the prevention of the formation of meningitis foci would seem the most reasonable point of attack. Isolated or so-called sporadic cases of meningitis will always be likely to occur among new Army recruits and will often be very difficult or impossible to connect with any other center of infection. But careful inquiry will doubtless show that even in such cases a connection can be traced more frequently among soldiers whose movements can be fairly definitely ascertained than among members of the civilian population.

On the whole, the position that seems most clearly justified at the present time is not to abandon the examinations for meningococcus carriers, but to make such examinations on a reasonable scale under all conditions in which military exigencies do not forbid. To obtain the best results the examination should be made as soon as possible after the existence of a meningitis case is suspected, and the laboratory methods used should be rapid and precise. The available evidence indicates that such a procedure is valuable in checking the spread of meningitis. The success of preventive measures in any disease is beset with some degree of uncertainty. The fact that we cannot assert in any particular instance how many cases of meningitis have been prevented is no argument against the judicious application of meningococcus carrier control.

**Netter, A., Salanier, M.** SECONDARY PNEUMOCOCCUS INFECTION IN MENINGOCOCCUS MENINGITIS. [*Arch. d. Med. d. Enfants*, Sept., 1917.]

These authors present the analysis of twenty-two cases, five their own, of children in whom a pneumococcus infection was superposed upon a meningococcus infection, in most instances when the latter had seemed to be under control. All but three cases proved fatal. The pneumococci evidently penetrated from the nasopharynx to the meninges and seemed to destroy the meningococci already installed. The children who recovered had been given preventive injections of antipneumococcus serum, which should be given in such conditions in addition to the antimeningococcus serum.

### III. SYMBOLIC NEUROLOGY

#### 3. PSYCHOSES.

**Comby, J.** MONGOLIAN IDIOCY. [*Arch. de Med. des Enf.*, Dec. 20, 1917.]

According to Comby's experience mongolian idiocy is much more prevalent in France than the earlier literature would show. He has found sixty-nine cases during the last thirteen years at Paris. He believes that it has probably often been confused in the past with myxedema, rachitis and athrepsia. He describes his series in detail but finds no special inherited traits nor any consanguineous marriages. The effect upon pregnancy of the advanced age of the mother and of unusual grief, worry or privations appeared as a causal factor in some cases. He believes that Mongolian idiocy is due to some definite lesion before birth, which has arrested development and which cannot be remedied. As these individuals are very susceptible to pneumonia and tuberculosis, which is usually early fatal with them, the most that can be done for them is to protect them against exposure to cold and to tuberculosis. Medicopedagogy may be able to do something for them and moderate thyroid treatment might hasten growth.

**Helweg, H.** WANDERLUST. [*Ugeskrift f. Læger*, Jan. 31, 1918.]

The pathologic impulse to wander away without apparent motive is said by Helweg, in support of other observers, to be a symptomatic manifestation in other conditions than in epilepsy alone. The French have mentioned it as a manifestation of hysteria. Other literature, he incorrectly states, seems to contain no reference to this tendency except in epilepsy and hysteria, four cases only being recorded in Danish literature. For himself he describes six cases in which this tendency was present, the patients apparently conscious of what they were doing. There is often in the literature reference to trauma of the head, which was true in five of his cases. In one patient there was also inherited mental taint, though when placed in an institution after periods of wandering no other abnormalities were discovered. It was after a second injury to the head that she had begun wandering from home. After this she had gone away repeatedly, staying at hotels, pawning her belongings and even stealing the money for her escapades. No erotic tendencies manifested themselves, though she had on one occasion been accompanied by a man, a chance acquaintance. Occasionally she had no clear remembrance of the times of being absent from home. Women seem to be as prone to this phenomenon as men as far as the psychopathic condition responsible for it, but it is not made active by abuse of alcohol as often with men, and has generally other ways of manifesting itself. Running away usually occurs after a quarrel or other unpleasantness and one man in military service ran away repeatedly to his wife. The author believes that the tendency needs no definite

designation as a special mania, but is the same thing no matter with what diseased mental condition it is associated. The great amount of literature on wanderlust in mild dementia præcox cases does not receive the proper attention by this author.

**Tramer, M.** POSTOPERATIVE PSYCHOSES. [Correspond. Bl. f. Schw. Aerzte, Feb. 23, 1918.]

In the two cases which Tramer reports extreme dread of the operation seems to have been a factor in the causation of the psychosis. Surgeons should recognize such an abnormal dread and warn the family as to its possible psychotic outcome. Tramer considers these cases of a benign character and susceptible to skilled treatment.

**Stokes, C. E.** NARCOTIC ADDICTION. [J. A. M. A., March 16, 1918.]

The military, industrial and public health features of narcotic addiction are discussed by the author. He claims that in some sections of the country 90 per cent. of the narcotic victims are heroin users, and nearly all of these are in the period of adolescence, and many have reached military age. It would be illogical to expect 100 per cent. efficiency at the outset of treatment of these persons, but with proper care and study many of them can be redeemed. Sooner or later the condition develops individualistic fetters. A chronic depression of nervous functions, and, further, this depression involves the ductless glands and other organs, causing disturbances of nutrition and emotional disorders, which are especially evident when the drug is suddenly stopped. From his experience with drug addicts, gained while in charge of an institution for their care and cure, it was clearly shown that they could be controlled by enlightened methods of discipline and administration, with proper environment. It is time, he says, that an educational drive be started, in which this problem can be taken up, stripped of its mystery and sensationalism, and the facts of the situation laid bare.

**Lafora.** ORGANIC BASIS OF DEMENTIA PRÆCOX. [Siglo. Med., Dec. 8, 1917.]

Lafora supports the toxic origin of both physical and mental symptoms of dementia præcox through imperfect functioning of the sexual glands. The protective ferments of the blood do not properly act upon their products so that they circulate in the body as toxins chiefly injurious to the brain cortex and probably the vegetative nervous system. He believes that the remissions which sometimes occur indicate the temporary suspension or neutralization of these products. The dementia præcox inheritance may be an inferiority of the same gland or of different glands and is Mendelian in appearance.

**Evarts, Arran B.** THE EPHEBIC PSYCHOSES. [Am. Jl. Insanity, 74, 1917, 1.]

The authoress considers, first, the characteristics of adolescence, and the bearing of the changes which occur at that time upon mental in-

stability, next describes four cases, all in negroes from fourteen to sixteen years old, in whom, though the symptoms closely resembled those of hebephrenia, there was recovery apparently without mental impairment. Three of the four cases showed mental retardation by the Binet tests, the fourth passed the tests for her age. She feels that we have here to do with a class of cases somewhat different from dementia præcox and of more favorable prognosis and proposes for them the name "ephebic psychoses."

**Lowrey, Lawson G.** SOME OBSERVATIONS ON THE RELATIONSHIP BETWEEN SYPHILIS OF THE NERVOUS SYSTEM AND THE PSYCHOSES.  
[Am. Jl. Insanity, 74, 1917, No. 1.]

A study based upon eleven cases showing a divergence of the clinical and serological pictures.

1. Of about 2,500 cases examined in three years eleven are sufficiently unusual to be reported on.

2. Of these, four gave the clinical picture of dementia præcox, one of constitutional inferiority, one of imbecility, two organic, and three paretic dementias.

3. In two cases of dementia præcox, the serology of neurosyphilis was found early. In the other two only after many years. In none was it expected. One case has tabetic symptoms, the other no symptoms of neurosyphilis. The case with tabetic symptoms also exhibits catatonic symptoms.

4. These are the only cases of dementia præcox in the hospital showing such serology, though other cases have positive blood tests.

5. One hysterical or constitutionally inferior person developed secondary syphilis five years before death. A year before death, the serology of neurosyphilis was demonstrated. Autopsy confirmed this. No clinical symptoms.

6. An "imbecile" developed general paresis in the hospital. Autopsy and serology typical.

7. An "organic" case without signs of paresis gives the serology of it.

8. A case clinically of Huntington's chorea gives the serology of paresis without clinical signs of it.

9. One case, clinically paresis at first, seems now like dementia præcox, serology positive.

10. One case, clinically paresis, has run an extremely long stationary course. Wassermann negative in blood and fluid, other tests positive.

11. One case clinically and serologically paresis, has as his most prominent symptom, the only one at the present time, auditory hallucinations.

12. We have to do with (a) neurosyphilis in unusual causal relations, or (b) coincident psychoses and symptomless neurosyphilis.

13. Diagnoses should be based on both clinical and laboratory findings. The neglect of either may lead to improper results.



**Fell, Egbert W.** THE DIAGNOSTIC VALUE OF SPECIAL FLUID AND WASSERMANN TESTS IN PSYCHIATRY. [Am. Jl. Insanity, 74, 1917, No. 1.]

At the Elgin State Hospital in 500 cases in which paresis was suspected serum and spinal fluid Wassermann tests, globulin tests, and cell counts were made. Of these 215 were luetic and 285 were non-luetic psychoses. The number of cases of tabo-paresis and cerebrospinal syphilis was not sufficient to draw any conclusions except to say that the findings were less constant than in paresis.

In paresis the tests failed as follows: Globulin increase in 2 per cent., pleocytosis in 16.5 per cent., serum Wassermann 7 per cent., fluid Wassermann 4 per cent. In the non-luetic psychoses the tests were positive as follows: Globulin increase in 5.5 per cent., pleocytosis in 3.5 per cent., serum Wassermann in 9.5 per cent., fluid Wassermann in none. Cell and globulin increase in non-luetic psychoses were found especially in organic cases where a differentiation was important. There is abundant evidence that positive fluid findings may occur without paresis in the primary and secondary stages, and it is probable that they occur without the mental symptoms of paresis in the "prepsychotic" stage.

A positive spinal fluid test is not in itself conclusive of paresis, nor does a negative test exclude it. It is, however, so constantly positive in the one case and negative in the other, that it is of the greatest value in distinguishing between a luetic and a non-luetic psychosis.

The extent of the paresis cannot be determined accurately by laboratory tests. We can only say that globulin and cell increase seem more marked in the more rapid cases.

The distinction between a paretic and a tertiary luetic process cannot be determined in the laboratory. The gold chloride test is of some help, but the therapeutic test is the only one of much value. The diagnosis of the combination of paresis with a functional psychosis should be made with extreme caution.

In making a diagnosis of recovery in a case of paresis which has cleared mentally, we should consider: (1) A functional psychosis in the primary or secondary stages of syphilis, (2) a functional psychosis in the pre-psychotic stage of paresis, (3) a remission in paresis. The first two occur quite infrequently, the last very frequently, the spinal fluid findings remaining positive.

**Auer, E. Murray.** PARANOID TYPES IN SYPHILITIC DISEASE OF THE CENTRAL NERVOUS SYSTEM. [Am. Jl. Insanity, 74, 1917, 1.]

The author reports six cases, five males and one female, all showing delusions of persecution more or less systematized and with the clinical and laboratory findings of cerebral syphilis or general paresis.

## Book Reviews

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**Dercum, Francis X.** A CLINICAL MANUAL OF MENTAL DISEASES.  
Second Edition, Revised. P. Blakiston Sons & Co., Philadelphia.

This book follows the plan and outline of the first edition of the work. It adds to the already very full descriptive discussion of the various forms of mental disorder, certain newly discovered facts and various hypotheses, which enlarge the conception of etiology and method of approach to these disorders. These are mainly along the line of internal medicine, somatic factors, upon which the author always lays stress. His chapter upon psychology has, however, also been considerably extended.

The introduction to the subject reiterates the consideration of mental disturbance as disease, instead of a strange aberration mostly conceived as moral ease, the scientific attitude, still needing emphasis, the author rightly believes, even now. He then proceeds to define briefly first in general terms of neurological change, anatomical or functional, and then of mental phenomena, what is understood by "insanity" and "alienation." He discusses briefly also the meaning of various specific terms which denote symptomatic manifestations in mental disorders. His further treatment of the subject is based upon the concepts "neurasthenic," which he defines to include those symptoms indicative of exhaustion and chronic fatigue, and "neuropathic" which he applies to the fundamental deficiencies and aberrations of the nervous system which predispose it to disease. The former is purely functional; the latter seems to include both morphologic and functional factors, a distinction which is hardly clear or convincing.

There is no attempt at a hard and fast classification throughout the exhaustive description which follows, of the various forms of mental disease, for Dercum admits the uselessness and inaccuracy of any such delimiting separation of such disturbances. For reasons of descriptive convenience and clearness as well as of clinical approach some separation is however necessary, and such is made and discussed in the varied forms and features in detail. The book forms thus a useful manual to the student and clinical worker and its matter is presented in a very readable form.

The retention of the term neurasthenia and also of that of psychasthenia, to which latter the author himself offers objection, are in keeping with his emphasis upon the etiology of exhaustion and toxic or other physiological factors as paramount, or almost exclusive, it

would seem, in the causation of mental disorder. Too much emphasis cannot be laid upon these where they exist, nor still more upon the influence of the glands of internal secretion. This is done here, though, at the expense of the psychic factors, and of the recognition of the interrelation between psychic and somatic phenomena, especially in the case of the internal secretions. Clinically it would seem of far more value were the psychic elements incorporated in their place in the gradual development of the discussion, both in order to give them their proper weight and to receive the light which these throw upon diagnosis, interpretation and prognosis. Perhaps that would have excluded treatment from a separate brief chapter at the end and incorporated that also in the interpretative discussion as it proceeded.

This however calls for the chief criticism of the book, the lack of this interpretative and therefore more practically illuminative attitude toward the whole subject. This is evidently due to an inability to conceive of that informing unity which causes the interplay constantly of psychic and somatic factors, and finds therefore in mental life and its states a true dynamism, an energy movement of which mental aberrations are partial and deviate expressions. There is place in such a conception for readjustment extending much further than mere neuronie nutrition, and indeed most conducive to improved nutrition, with which it is interrelated as cause as well as effect.

The depth and the force of deep-lying psychic factors are not appreciated nor the movement of energy which they indicate as available for psychotherapeutic readjustment. For this reason arise such statements as that psychoanalysis can play only on surface symptoms, the underlying basic condition never being influenced. This is only one of the many misstatements which result from the absence of this deeper causal interpretation, which must supplement internal medicine, perhaps even bear the greater emphasis. The chapter on psychologic interpretation contains also an enlargement of the former interpretation of dementia præcox in terms of reduced dynamism of the cortex and of conscious activity, permitting of other activities, complexes, flowing into the field. The interpretation of complexes here and elsewhere leads to a discussion of psychoanalysis. The author has built up this exposition here like a house of cards in order that, it would seem, he might pull it down with a fuller crash than heretofore. The weak spots at which he thinks the whole structure is easily destroyed are such as the persistent emphasis on that early abandoned idea of Freud's, which has always seemed to have an ineradicable hold upon his critics, the necessary sexual trauma in childhood. Of course this is bound with the other misunderstandings which seem to constitute the points of attack, particularly narrowness of comprehension of the meaning of sexual and sexual experiences, especially as pertaining to childhood, and misconception of the term libido from failure to get the energetic point of view for human psychic life. This manual would be of great instructive

and clinical value could the whole discussion from beginning to end be infused with such a conception of psychic life underlying all these manifestations and this would extend beyond these misunderstandings, which now limit the descriptive value and prevent the essential profound entrance into them which psychotherapy as well as internal somatic therapy demands.

JELLIFFE.

**Baldwin, Agnes.** *SYMBOLISM ON GREEK COINS.* New York, The American Numismatic Society.

The author of this interesting monograph has made a beginning in the application of a true interpretative psychology to a special branch of symbolism and mysticism. That is, she has endeavored to make the expression of certain practically world-wide symbolisms, used on ancient coins, as well as in many other places, not a matter of accident or artificial creation later copied from one group of people to another. She considers them really as a language of the inner thought and feeling of the people who originally used them, and at least unconsciously of later peoples who adopted them.

Later interpretations have been superimposed upon the original ones, the latter being of course difficult of clear discovery. Yet the universality of the symbols, their sometimes apparently spontaneous appearance in different parts of the ancient world and their continued use aid in the tracing back of the meaning to the original use of them as expressive of inner psychic aspiration. The author begins with the fish symbol as it had become secondarily adopted and interpreted in Christian usage, and extends her study chiefly to the swastika, so frequent particularly on ancient coinage, the triskeles, the winged disk, and the ankh. The first three represent motion and are probably sun symbols, while the last is especially the sign of life or of living. Thus she sees in them all original libido symbols, according to Jung's development of the idea of the libido as the creative urge and aspiration of mankind.

Baldwin discusses to some extent the application of this libido interpretation to ancient symbolism and the possibility which lies therein for a deeper understanding of this as of other human productions and usages. She also attempts to apply this, as has been stated. She has, however, only touched upon the problem, not having pressed the interpretation to an actual definition of human striving or a particular, well-defined discovery of it in these symbols. Nevertheless it is all an effort in the right direction and a proper caution is surely more useful than a premature interpretation which forces meanings which do not really appear. However, more detailed knowledge is necessary if the history of the past, written in such symbols, are to help us in the understanding and adjustment of the inherited mental life of the present. From the numismatic point of view here monograph is a work of wide

survey and offers a valuable collection of material well classified and attractively and instructively presented.

**Jelliffe, Smith Ely.** *THE TECHNIQUE OF PSYCHOANALYSIS.* New York and Washington, Nervous and Mental Disease Publishing Company.

The beginner in psychoanalysis will find in this new publication an invaluable guide to the understanding of what psychoanalytic therapy aims to do and in the details of its application to daily practise. This the author modestly claims as the full purpose of the book. It contains, however, a far greater fund of stimulus and help. No other writer has so clearly and fundamentally presented to the beginner himself the reason for the method of psychoanalysis simply as a more perfected tool, one which in the progress of events cuts more deeply into underlying causes and factors of mental difficulties and brings them out to light, than those of the past history of medicine. He sets psychoanalysis therefore in its place as an outgrowth of previous thought and effort, an advance upon them but itself subject to the modification of growth and evolution. It is therefore a living tool in the hands of the would-be psychotheraputists and yet the necessary limitations of its applicability, as of any other human instrument, and the care, circumspection and self-knowledge with which it must be used are no less insisted upon. The dynamic nature of the material upon which it is to be used, in the psychical nature both of the patient and of the physician as well, the recognition of which is the strongest feature of psychoanalysis, is made the reason for caution and for emphasis upon the far-reaching character of psychoanalysis. This gives it its power for effective and equally far reaching therapy, while at the same time surrounding it with the danger which arises from careless or unwise handling of any dynamically charged substance.

Growing as it has out of the author's daily clinical experience, the book lacks perhaps some of the definiteness and precision of presentation, which a further perspective of thought might have given it. Yet this is offset to a large extent by the freshness and vitality of the material presented as it comes hot from his own experience and infused by his comprehensive grasp and clear penetration of individual mental problems as well as of the whole genetic aspect of mental disorder.

Particularly valuable is the material he has incorporated from Freud and other foreign writers who have entered most thoroughly into the important question of the transference. Jelliffe has fully interspersed this with his own experience and earnest consideration of this important feature and its fundamental place in the technique. His conception of the evolutionary unfolding of cultural adaptation and maladaptation, which latter, interfering with culture, causes mental illness, and of the psychoanalytic purpose and direction of the technique toward

a re-adaptation, form the keynote of the whole book. This causes the author also to lay particular stress on the solving of the conflict, the reconstructive side of psychoanalysis, without once losing sight of the necessary exhaustive analysis preceding it. This is all strikingly represented in a graphic form, which appeals as an aid to the psychoanalyst in himself grasping the situation and in presenting it during the analysis to the patient. The psychograms of this development, the fitting of dream interpretation into them and their aid in the readjustment, form a unique and very practical feature of the book.

The book stands where much of psychoanalytic effort must still stand, representative of the somewhat immature and only partially formulated theory and technique. It represents, however, still more impressively the fluid and therefore vital nature both of the science and philosophy of the psychoanalytic principles and of their practical application.

LAMBERTSEN.

**Severn, Elizabeth.** *THE PSYCHOLOGY OF BEHAVIOR. A Practical Study of Human Personality and Conduct with Special Reference to Methods of Development.* New York, Dodd, Mead and Company.

Any book which opens the way into a better understanding of our psychical makeup and points the way to a readjustment of it when that has failed or become disturbed is of greatest practical value. The present volume promises much in this direction in brightness and alertness of style and in its very readable discussions of many of the generalities of psychical life, but it is singularly disappointing in its definite application to the problems of maladjustment and readjustment. Yet these are the things upon which the author professedly especially directs her effort as an avowed psychotherapist and in her treatment of the subject matter of this book.

Her attitude is too predominantly a descriptive one as she presents one mental factor after another or dwells upon the various elements which are comprised for example in emotion and its forms of manifestation, or in love and its varying aspects. Her classifications are vague and unmeaning, standing rather, in so far as they may be of service, as end products than taking us into the causal interpretation of the sources of behavior and therefore the territory for psychotherapy. The generalizations however attractively expressed cannot get at the fundamental outreaching of psychic energy and its devious ways of expression or of distraction. Such an approach is not wholly neglected but it is not really comprehended and therefore the presentation loses itself in the well rounded platitudes of advice and admonition, before which many a hopeless patient has sunk yet more hopelessly discouraged. The hidden unconscious difficulties lying deep within are only driven to greater tenacity in their strongholds when such unattainable abstractions are put before them. The fact that there have always been religious

movements and therapies of various sorts toward which certain individuals could so transfer their burden wholesale and come away renewed able to meet life gives this form of psychotherapy a certain plausibility. This gives it however no real scientific claim to consider itself an equivalent or substitute for the exhaustive form of treatment which seeks to the uttermost for individual causes and factors. The author claims to have made partial use of psychoanalysis but certain gross misunderstandings and inaccuracies of statement prove no real knowledge of it or of its principles and methods. To say that the Freudians fail to reconstruct by a careful synthesis after an analysis is to miss the very strength and morale of the psychoanalytic therapy. A mysticism and animism which pervade the book also serve to obscure its definite scientific value.

L. BRINK.

**Dawson, E. Rumley.** *THE CAUSATION OF SEX IN MAN. A New Theory of Sex Based on Clinical Materials together with Chapters on Forecasting or Predicting the Sex of the Unborn Child and on the Determination or Production of Either Sex at Will.* New York, Paul B. Hoeber.

There seems to be no room for doubt left in the mind of the author of this book that he has fully established the problem of sex determination. His assurance is supported by the ardent testimony of numbers of people who have followed his directions and procured the desired boy or girl and by statements of his correct prediction in certain royal families.

His theory is that sex is determined only in the female ovum and that the male child is a result of fertilization of the ovum from the right ovary and the female child of that from the left ovary. The sex of the first child being used as the starting point, the sex of the succeeding children can be predicted if it is known in detail when the next pregnancy began in relation to the time of the first conception. By carefully following the alternation of ovulation during the months succeeding the first pregnancy, including a reckoning of the intervening months when ovulation did not take place, it can be determined which ovary is expected to functionate at a given time and impregnation can be planned accordingly to result in the desired sex. This is based upon the fact of the regular alternation of ovulation from the right and left ovary. Of course this does not provide for the determination of the sex of the first child, which is not however of so great importance if succeeding births can be controlled.

The book is occupied with the anatomy and physiology of the generative organs, particularly of the female. The theory advanced is profusely illustrated by anatomical data, clinical experience and by published and personal observations upon the proportion of sexes in various families, with as far as possible knowledge of attendant circum-

stances. The theory and its support add another possibility to the speculations and to the investigations in the consideration of this problem. The assumptions are too often based upon too generalized evidence to make it as convincing as the author would have us believe, that the last scientific word had been said in regard to the obscure and subtle differentiation of the developing fertilized cell or its previous determination as to sex.

JELLIFFE.

**Groszmann, Maximilian P. E.** *THE EXCEPTIONAL CHILD.* Containing a Medical Symposium with Contributions from a Number of Eminent Specialists. New York, Chicago, Boston, Charles Scribner's Sons.

There is here a study, this time from an educator, on the subject of the child who needs special attention and training because of exceptional disability or of specialized ability. For the latter is also not left out of account, but as the author takes pains to show likewise needs particularized care and direction. Too often such special ability is a development at the expense of the other powers and manifests a psychic imbalance.

The entire subject is discussed in detail under the headings familiar in this subject. Feeble-mindedness is one of these, what it really is and the difference between actual mental deficiency and merely remediable non-adjustment. Juvenile delinquency is the subject of consideration and sexual perversion and prostitution as they relate to the problem of children and their training, particularly in regard to the exceptional child. There is also space devoted to methods of testing children. Particular attention is given to the responsibility of the school and the kind of education which is or should be available, with a word as to the training of teachers. Home life and education also are not left out of account.

The book forms a sort of encyclopedic volume of reference upon this practically very extensive subject. It is full of reference to leading educators and other thinkers who have pursued this line of investigation and practical endeavor or of other writers who can throw light upon the subject. Besides the author himself has let no detail of the subject escape his attention. The result however is a volume rather too prolix to be as practical and convincing as a more concise presentation might have been. The use of certain psychiatric terms which have proved themselves void of applicable meaning detracts also from the definiteness and illumination, which should give a clearer insight into determining causes and the attack of these problems through them alone. The recognition of such a deeper causal background in the profound, unconscious psychic life of the child is wanting. Yet there is an appreciation of a graduated development of civilization in society and in the individual, with a primitive inheritance behind it, but the author has not made sufficient use of this important fact.

JELLIFFE.



# The Journal OF Nervous and Mental Disease

An American Journal of Neurology and Psychiatry  
Founded in 1874

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## Original Articles

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### PARENCHYMATOUS ATROPHY OF THE CEREBELLUM \*

A CONTRIBUTION TO THE SYMPTOMATOLOGY OF INTRINSIC CEREBELLAR DISEASE

BY LA SALLE ARCHAMBAULT, M.D.

ALBANY, N. Y.

Following the remarkable work of Luciani, who may justly be regarded as having laid the foundation of our present conception of the physiology of the cerebellum, there began a whole series of anatomical, experimental and clinical researches, which were destined to entirely recast in an incredibly short time the views held by earlier investigators concerning the functional significance of this organ. The acquisitions of the last few years have been especially numerous and valuable. The task of redeeming the cerebellum from the so-called silent domains of the cerebro-spinal axis has been shared by so many observers scattered all over the world and the facts thus far published represent such a towering accumulation of significant data, that one urgently feels the necessity of halting a moment for the wholesome purpose of an orderly readjustment and classification. An effort in this direction was recently made by Mills and Weisenburg (41) and it is hoped that further attempts of a constructive sort will succeed in harmonizing and amalgamating the huge mass of still partly discordant facts.

\* Read at the forty-fourth annual meeting of the American Neurological Association, Atlantic City, May 9, 10, 1918.

It is not within the scope of this paper to delineate the successive evolutions in the history of the cerebellum but it behooves us to recall the contributions on the anatomy and comparative anatomy of this organ furnished by Cajal, Van Gehuchten, Edinger, Bolk, Elliott Smith, Bradley and others; the experimental researches of Munk, Risien Russell, Ferrier and Turner, Horsley and Clarke, Mingazzini, André Thomas (2, 7, 8, 9, 10), Bing, Marburg, Lewandowsky, Mott and Sherrington, Luna, Pagano, Hulschoff-Pol, Adamkiewicz, Van Rynberk, Prus, Rothmann (49-52, 56) and a host of others, including the very recent experiments carried out in this country by Ernest G. Grey (33) of the Peter Bent Brigham Hospital; finally the clinical studies of Dejerine and Thomas, Babinski (17), Neumann, Stewart and Holmes, Rothmann, Bárány (18-22), Mills and Weisenburg (40-42, 61). These are only a few among the more important publications which collectively have served to establish upon a firm and scientific basis the newer interpretations of the physiology and consequently of the clinical pathology of the cerebellum. Not only have we learned to recognize the specific symptoms of cerebellar disease, *i. e.*, to isolate those which are strictly dependent upon intrinsic cerebellar involvement from others due to lesion of extrinsic or para-cerebellar structures, but we are now likewise resolving without doubt the even more attractive and vital problem of cerebellar localization. Of course it is a fact that while some of the more recently described cerebellar symptoms are regarded as truly pathognomonic by the majority of observers, there still exists considerable diversity of opinion concerning the actual significance of others. This is due partly to misinterpretation of the claims advanced by some investigators and partly to lack of uniformity in the definition and verbal designation of symptoms. Those who criticized the conclusions of Babinski, for instance, have forgotten that in describing *adiadochokinesis*, *asynergy* and *cerebellar catalepsy*, this author never went further than to attribute these phenomena to perturbation of cerebellar function, clearly specifying that they could result from lesions involving either the cerebellum itself or its peduncles. Again it may be noted that it is decidedly confusing to find that a given term has been employed in a widely varying sense by different writers, and, inversely, that many neologisms have been introduced to designate symptoms which, upon closer analysis, simply represent different clinical expressions of one and the same fundamental physiologic disturbance. Hence the need of a speedy revision and appropriate reclassification of the phenomena resulting

from disease of the cerebellum and its dependencies. As regards cerebellar localization, it must be remembered that most of our present notions are based essentially upon animal experimentation and that it is extremely difficult to even approximately identify in the human cerebellum the lobules or regional subdivisions which anatomically correspond with the functional centers experimentally delimited in the cerebellum of the dog or monkey. It cannot be questioned, however, that the phenomena observed in man in cases of circumscribed lesions of the hemisphere are closely analogous in many respects to those produced by partial extirpations in the lower animals. André Thomas has recently published several cases which serve to emphasize this fact and in the course of his interesting studies on passivity and anisosthenia (11-16) he has well demonstrated that the peculiar attitudes and muscular reactions of the extremities observed in his patients were in large measure comparable to the abnormal positions of the limbs which followed partial hemispherical resections in animals. There is no reason why the results achieved in the experimental laboratory should not be utilized as an aid to clinical diagnosis, but of course it must always remain the ambition of the neurologist to affirm his knowledge through observations gleaned from the domain of human pathology. It is for this reason that every case of cerebellar disease properly studied clinically and verified either surgically or anatomically is so valuable. Progress in this restricted field of observation is necessarily much slower and far more difficult to realize. The diversity of the lesions encountered is the main source of discrepancy and therefore the chief obstacle to satisfactory progress. Cerebellar tumor and abscess are only of limited value by reason of direct compression of neighboring structures and of generalized intracranial hypertension. Vascular lesions such as hemorrhage and softening are more serviceable and, as Thomas pointed out, they are the only type of lesion which can be compared to the experimental ablations or destructions practised upon the cerebellum of animals. "In both cases there is a sudden suppression of the organ and its functions." It is a fact nevertheless that such vascular lesions either directly or as the result of peri-focal edema do cause transitory enlargement and therefore compression of the proximal structures. Moreover, even granting the inadequate clinical observation of many of the reported cases, it is a fact that hemorrhages and softenings strictly limited to a cerebellar hemisphere have given rise, in many cases, to practically no characteristic manifestations of cerebellar disease. I have had two such

cases recently and repeated examinations failed to disclose any of the classical signs. Practically the only group of cases in which the symptomatology can be unmistakably and exclusively attributed to structural changes in the cerebellum is the group represented by the degenerative atrophies of the cerebellum. Even here however another difficulty arises and that is the functional compensation supplied by the cerebrum and which in a large measure keeps pace with the slowly progressive structural deficit occurring in the cerebellar cortex. It is therefore probable that in virtue of this compensation, the symptomatology of the cerebellar atrophies rarely yields the full clinical equivalent of the underlying organic deterioration. However, cases of this type are of extreme value and while the condition has been known for a long time there are very few observations on record in which both clinical study and anatomic examination have been adequately covered. This is my reason for reporting the present case.

Atrophy of the cerebellum has been encountered under very different conditions and the cases thus far reported may be grouped under the following headings:

1. Congenital atrophy of the cerebellum in which all parts of the organ are normally and proportionately developed without any structural changes to account for the reduction in volume.
2. Secondary atrophy of the cerebellum due to extensive lesions of the cerebral hemisphere and in which the atrophy is either contralateral or bilateral according to the unilateral or bilateral involvement of the cerebrum.
3. Sclerotic atrophy of the cerebellum secondary to inflammatory and vascular lesions in the meninges and cortex of the cerebellum, *i. e.*, secondary to cerebellar meningo-encephalitis.
4. Atrophy of the cerebellum occurring as an independent and apparently primary state and associated with systematized degenerative changes either limited to the cortex (primary parenchymatous cortical form) or involving both the cortex and the related nuclei and fiber bundles of the pons and medulla (olivo-ponto-cerebellar type of Dejerine and Thomas).

It is to Dejerine and Thomas (28) that we are indebted for our knowledge of the atrophies included under the fourth heading, *i. e.*, of the atrophies in which the progressive disappearance of the Purkinje cells, the atrophy of the various layers of the cortex and the subsequent degeneration of the medullary substance take place in the absence of any appreciable inflammatory or vascular changes

or of any material neuroglial hyperplasia. The cases of this kind which have been published in recent years with complete clinical examination and detailed anatomic findings are so few that it seems desirable to incorporate here a brief sketch of the main clinical manifestations and histologic changes. Doubtless many such cases have been observed by earlier clinicians but the information given regarding symptoms is so meager and the anatomic investigations so inadequate (owing of course to the then undeveloped laboratory methods) that they are of extremely little value in any discussion of the present day.

An exception should be made perhaps for the cases reported by Pierret, Fraser, Schultze, Menzel, Nonne, Royet and Collet, Arndt, Miura, all of which were well reported. In some of them, however, the lesions were not limited to the cerebellum and its dependencies and in others the anatomical examination was incomplete. Pierret was apparently the first to report a case evidently belonging to the group of olivo-ponto-cerebellar atrophy, but no mention is made of the spinal cord. In the cases of Fraser and of Royet and Collet the histologic examination likewise appears to have been very incomplete. The cases examined by Schultze and by Arndt presented, aside from marked degeneration of the pyramidal tract, severe meningo-vascular lesions. The case of Nonne apparently was an instance of congenital atrophy as the histologic findings were normal. Menzel's case showed well-marked involvement of the pyramidal tracts. Finally, in Miura's case there were associated changes in the peripheral nerves and in the retinae. All of these cases have been well abstracted by Thomas (2, 7), but it is evident that while they are extremely interesting they cannot properly be regarded as instances of primary and systematized degenerative atrophy of the cerebellum.

The first two cases of olivo-ponto-cerebellar atrophy examined by means of serial sections were published in André Thomas's original thesis (2) where they figure as observations IV and V. In Thomas's first case (Observation No. IV) the onset occurred at the age of 55 with gradual development of weakness in the right arm and leg, followed by increasing disturbance of speech characterized by scanning and nasal intonation. In standing and walking the legs were abducted, the trunk oscillated, the gait was typically cerebellar, and the right leg was suddenly thrust forward. The fingers of the right hand occasionally exhibited a rhythmical flexion and extension tremor, the tongue was slightly deviated to the right. The patellar reflexes were exaggerated particularly on

the right side but there was no ankle clonus. Romberg's sign was absent.

Anatomically, the cerebellum and pons were very small but with normal configuration. The atrophy of the cerebellar folia involved both the vermis and the hemispheres and histological changes were present both in the cortex and in the axial medullary substance. The Purkinje cells were greatly reduced in number but not to the same extent in all regions; they were totally wanting in some folia, whereas in other folia they still persisted in considerable numbers, though decidedly atrophic and feebly stained. The granular layer had entirely disappeared at certain points and contained very few myelin sheaths even in regions where it was relatively intact. The medullary substance was decolorized, the fasciculi greatly thinned and sinuous. There was no associated sclerosis and no vascular lesions. The central ganglia were intact. The transverse fiber strata of the ventral segment of the pons had completely disappeared and the middle cerebellar peduncles were totally degenerated. The superior cerebellar peduncles, red nuclei and thalami were normal. The bulb was slightly atrophic, the inferior olives very small, their cells either wanting or shrunken and their fiber-system reduced to a few rare myelin sheaths. The accessory olivary bodies were greatly atrophied and the arcuate nuclei, together with the antero-external arcuate fibers, totally wanting. The restiform bodies were much reduced in size and decolorized generally but more especially in their mesial segments. In the spinal cord a slight degeneration of the marginal layers of the lateral columns was present, particularly in the dorsal and lumbar regions.

In the second case published by Thomas (Observation No. V) the onset occurred at the age of 25 years and the first symptom was the progressive development of weakness in the lower extremities, together with attacks of tremor brought on by the slightest emotional disturbance. Later intention tremor in the extremities and defective speech became evident. The gait was characterized by insecurity and titubation and actual falls were frequent. Still later walking became impossible, the trunk was the seat of wide oscillations and even when the patient was seated the unsupported extremities described wide oscillations. The intention tremor of the upper extremities was analogous to that observed in multiple sclerosis. The protruded tongue exhibited oscillations and fibrillation. Speech was slow, scanning and slightly stuttering. There was no nystagmus. This patient presented an associated hysterical anesthesia which was generalized, involved all forms of

superficial and deep sensibility and even the special senses. The cutaneous reflexes were abolished.

At autopsy there was a generalized atrophy of the cerebro-spinal axis but far more marked in the pons and cerebellum. The changes encountered here were closely analogous to those detailed in the preceding observation. The molecular zone was much reduced, the Purkinje cells irregularly distributed, very scanty in certain regions, smaller than normal, deformed, poorly stained and frequently devoid of nuclei. The granular layer was less dense than in the normal state. The medullary substance of the folia was relatively well stained but much reduced in volume. There were no associated vascular lesions and no sclerosis. The ventral transverse pontine fasciculi and the middle cerebellar peduncles were extremely degenerated and the cells of the nucleus pontis and of the nuclei of the reticular formation were shrunken and deformed. The superior cerebellar peduncles and red nuclei were normal. The changes in the bulb were practically identical with those described in the first case excepting that the encapsulating fiber stratum of the inferior olives was less severely degenerated, in fact, the mesial segment of the stratum was relatively well preserved. The condition of the accessory olives, the arcuate system and the restiform bodies was the same as in the previous case. In addition, however, there existed a degeneration of the funiculi gracilis et cuneatus on both sides and the postero-external arcuate fibers were very few. Important changes, moreover, were present in the spinal cord. In the cervical region there existed a definite degeneration of the columns of Goll and Burdach and of the ventral and dorsal spino-cerebellar tracts. In the dorsal and lumbar regions the degeneration occupied mainly the central portion of the posterior columns and in a slighter degree the domain of the crossed pyramidal tracts. The cells of the columns of Clarke were markedly atrophic. In this case Thomas regards the atrophy of the cerebellum as being secondary to an atrophy of the afferent paths and their nuclei in the bulb and pons.

In the case of olivo-ponto-cerebellar atrophy reported by Dejerine and Thomas (28) the same gradual development of symptoms was noted. All the movements of the body were profoundly altered, whether they took place in the sitting or upright position. All changes of attitude were executed with slowness, hesitation, uncertainty and awkwardness and a fall frequently occurred. In standing, the lower extremities were markedly abducted, the elbows were likewise abducted and the body was the seat of considerable

antero-posterior and lateral oscillations. The patient experienced the sensation of an impending fall forward and could not maintain his equilibrium if the feet were brought close together. These disturbances were not increased by closing the eyes. In walking, the extremities remained abducted, each foot was lifted suddenly after some hesitation and replaced in the same manner. The steps were irregular and described a wavy line because the trunk oscillated and the body was carried either too far forward or backward or from one side to the other. There was neither paralysis nor atrophy but fatigue supervened rapidly. In holding the arms forward with fingers spread apart, there was no oscillation of the limb and no manifest tremor in the fingers, but the moment a delicate movement demanding precision was attempted the movement was slow and distinctly altered. Thus, when the patient tried to fill a glass with water, the hand holding the bottle oscillated and poured the liquid to one side. The writing likewise was tremulous, the letters irregular and unequally spaced and some of them unrecognizable. The movements of the head were slow and likewise all the movements of the facial musculature. The physiognomy was almost devoid of expression. Speech was slow, drawing and slightly scanning. The various movements of the eyes were normally executed, except elevation, which was interrupted by a series of nystagmiform shocks. Sensation was undisturbed throughout the body. The tendon reflexes were exaggerated but without ankle clonus or perversion of the plantar reflex.

The lesions in this case were practically identical in every respect with those described in Thomas's first case (Observation IV) with this difference that the restiform bodies were less severely degenerated and that the spinal cord was found to be intact at all levels.

Murri (44) reported the case of a woman in whom a typical cerebellar syndrome, preceded by severe paroxysms of vertigo, developed apparently in connection with a chronic enteritis of six months' duration. Unfortunately the original description of this case could not be obtained and the data related here have been borrowed from the very brief abstract contained in an article on this subject by Italo Rossi (48). The histological examination showed a marked diminution in the number of Purkinje cells throughout the cerebellar cortex, while the Purkinje cells which still persisted as well as the cells of the central nuclei presented changes involving both the nucleus and the chromatic substance. The molecular zone and the granular layer were intact and there was likewise no evidence of meningeal inflammation or of vascular alterations.



Under the name of "Lamellar Atrophy of the Purkinje Cells" Thomas (5) has published a most interesting observation. This patient, a woman of 54 years, had developed at the age of 40, as the first manifestation of cerebellar disorder, a slowly progressive titubation. Her previous history showed that she had had a number of diseases, including suppurative otitis media, typhoid fever, syphilis and alcoholism, and presumably also poliomyelitis in childhood.

Clinical findings: In standing and walking, the legs were abducted and the feet directed outward, the arms were also held in abduction and the trunk was the seat of antero-posterior and lateral oscillations. The gait was slow and distinctly cerebellar in type, the body being carried alternately too much to the right and to the left. The patient walked distinctly upon her heels, but did not throw the legs forward as in tabes. On the other hand there was definite dysmetria, the foot being raised abruptly and replaced in the same fashion showing at the same time a certain element of spasticity. The patient constantly kept the eyes fixed on the ground, although closing the eyes did not materially augment her disorders of equilibrium unless the feet were brought close together, in which case she was threatened with a fall. There was no motor weakness in the legs, but when the patient, being seated, attempted to raise either lower extremity and touch an object with the foot, an intention tremor analogous to that of multiple sclerosis at once became evident. There was likewise some atony in the musculature of the lower extremities, particularly in the flexors of the legs. A talipes equinovarus was present on both sides, but much more marked on the right. The patellar jerks were increased, the ankle jerks weakened. Excitation of the plantar surface gave rise to extension of the foot and of all the toes. The organic reflexes were normal, although urine occasionally escaped during paroxysms of coughing. The arms were absolutely free, there being neither motor weakness, ataxia nor intention tremor, and the tendon reflexes were normal. The face was negative, but a slight nystagmus occurred when the eyeballs were carried to either lateral angle. The pupillary responses were normal, as were also general sensibility and the special senses. The rotation or turning tests yielded normal nystagmic and pointing reactions. There was no definite disturbance of diadochokinesis. When the patient was properly supported and asked to place the foot on a chair there was no manifestation of asynergy such as described by Babinski, but in walking the left arm did not follow the right leg.

At the autopsy the gross findings were negative throughout; the meninges were not thickened and the cerebellum appeared practically of normal size. Histologically the mid-brain, pons and medulla were normal, changes being found only in the cerebellar cortex and affecting particularly the Purkinje cells, though likewise the molecular and granular layers. In certain lamellæ the Purkinje cells had entirely disappeared, whereas in neighboring lamellæ they were present in practically normal numbers, the transition being rather abrupt. In many places the absent Purkinje cells were replaced by a felt-work of neuroglial fibrils or else by numerous neuroglial nuclei, forming a definite layer between the molecular and granular zones. In some of the relatively normal lamellæ, the Purkinje cells nevertheless presented certain alterations; they were atrophic, surrounded by a network of neuroglial fibrils and their long dendrites were either shrivelled or totally wanting. The molecular zone contained more nuclei than in the normal state, as well as a certain number of amyloid bodies. The cells of the granular layer were diminished in number, irregular in form and did not take a uniform stain. The axial medullary substance of the various lamellæ was intact. There was no gliosis and no changes in the meninges and blood vessels anywhere. These various cortical changes were present both in the vermis and in the hemispheres and it was difficult to state whether they predominated in certain lobules although they were rather more marked in the superior than in the inferior vermis. In addition a patch of sclerosis was found in either anterior horn at the level of the third lumbar segment; on the right side the cells of the anterior horn were either wanting or reduced in number at different levels of the entire lumbo-sacral region. These cord changes Thomas regards as a residue of acute poliomyelitis.

Rossi (48) published the detailed observation of a case in which the lesions were so strikingly similar both in point of character and in point of distribution to those encountered in our own case, that it seems desirable to give a fairly complete description of his case.

The patient, a man 66 years of age, had developed the first manifestations of cerebellar disorder nine years before as he was recovering from a severe intestinal derangement of six weeks' duration. At that time he suffered from pains in the legs and difficulty in walking, his gait was that of a drunken man and he had to use a cane or crutch. His hands were feeble and awkward and during a period of fifteen days he was practically unable to articulate. Subsequently the speech disturbance cleared up, but the

locomotor instability progressively increased and nocturnal incontinence of urine occurred at times. At the time of Rossi's clinical examinations the patient's condition was characterized as follows: In walking the patient took short steps, each foot leaving the ground slowly but being then projected forward with considerable abruptness and then replaced with similar violence. There was a manifest rigidity in the movements. The gait was likewise accompanied by definite titubation, so that on the whole the gait was at the same time cerebellar and ataxo-spastic. The patient could walk without support, but usually relied on the use of a cane or crutch, without which he was unable to turn around. In standing he occasionally oscillated, but there was no lateropulsion. Romberg's sign was present. Muscular strength was well preserved in all the extremities although the left lower extremity was weaker than the right. There was no ataxia in the arms but a tremor somewhat analogous to that of multiple sclerosis was present. Diadochokinesis was distinctly impaired in the left upper extremity. In both lower extremities asynergy was exhibited particularly in connection with movements of flexion and extension. Static equilibrium in the dorsal decubitus was exalted. There was no evidence of hypotonia. The pupils were equal and yielded normal responses. The patellar reflexes were hyperactive. The plantar reflex was normal on the right and in extension (Babinski) on the left. The cremasteric reflexes were abolished and the abdominal reflexes retained. Aside from a faint hypalgesia in both legs, sensation was intact. Speech was slightly spasmodic and dysarthric. The subsequent evolution showed that all the symptoms gradually increased in severity, the patient became unable to stand upright without support, usually falling backward. The intention tremor in the arms became more marked and the Babinski phenomenon appeared likewise on the right side.

At the autopsy, the only anomaly was the definite and symmetrical atrophy of the cerebellum. Careful weighing and measuring showed that the volume of this organ was reduced approximately one fourth. The external configuration presented no abnormality excepting that over the anterior two thirds of the superior surface the superficial sulci were wider than normal and the lamellæ appeared narrowed. The histological changes were limited to the cerebellar cortex and involved all three layers in the most seriously affected lobules, whereas in other lobules or lamellæ they were confined to two of the layers or even to the layer of Purkinje cells. The most pronounced atrophic lesions were found

in the anterior and posterior quadrangular lobules, the flocculus, the culmen and the declive. Changes of lesser intensity were present in the lingula, the lobus centralis, the lobus gracilis, the digastric lobule and the pyramid. The semilunar lobules, the tonsils, the uvula and the nodule hardly presented any material alterations. In the more markedly diseased lamellæ the molecular zone was much atrophied, being reduced in some places to one half its normal width and the reduction being more apparent over the crests of the folia than in the depth of the interlamellar sulci. The dendrites of the Purkinje cells were either wanting or vaguely outlined, there was no multiplication of nuclei and no definite vascular changes, but corpora amylacea were everywhere abundant. The Purkinje cells had for the most part entirely disappeared, the few that remained were markedly atrophic, globular in form, devoid of nuclei and usually likewise of dendritic processes, or else were represented simply by minute irregularly round masses taking a feeble and homogeneous stain. The granular layer was reduced in thickness and likewise rarefied. The granules were less closely packed than in the normal state, stained imperfectly and in some points their rarefaction was so pronounced that an areolar appearance resulted. The changes in the granular layer were likewise most striking in the crests of the folia and were not accompanied by any proliferation of the interstitial tissue nor by alterations of the blood vessels. The medullary core of the folia and lamellæ offered a striking contrast by reason of its perfect integrity. In those lobules in which the atrophy was less accentuated, similar changes of lesser intensity were encountered, frequently with considerable variations in degree from one lamella to the next. In certain lamellæ all three layers were involved, but a certain number of Purkinje cells, mostly atrophic, still persisted; in other lamellæ the atrophy involved essentially the Purkinje cells, the granular layer being simply somewhat rarefied and the molecular zone intact; in still other lamellæ both the molecular and the granular zones escaped and the changes were strictly confined to the Purkinje cells which were either markedly diminished and more or less atrophied or else totally wanting. The dominant feature of this cortical atrophy was therefore represented by the disappearance of the Purkinje cells and Rossi believes this to have been the initial change in the process of cortical disintegration. The central ganglionic masses (*corpus dentatum*, *nucleus globosus*, *nucleus emboliformis* and *nucleus tecti*) were absolutely normal in every respect, showing neither generalized reduction in size nor cellular change. The only peculiarity noted was that the

stratum zonale which covers the lateral aspect of the corpus dentatum did not take a deeper stain than the surrounding white matter as is the case in normal sections, but on the other hand there was no evidence of fiber degeneration. The meninges of the cerebellum were not thickened, showed no cellular infiltration and their blood vessels, aside from slight thickening, presented no definite changes. The various cerebellar peduncles, the transverse pontine layers, the gray substance of the pons, the inferior and accessory olives, the olivo-cerebellar and arcuate systems were all found to be absolutely normal; in fact no pathologic changes were detected in any of the sections through the pons and medulla. Slight changes were present however in the spinal cord. Throughout the vertical extent of the cord there existed a slight and diffuse rarefaction more particularly of the central portions of the posterior columns accompanied by a slight proliferation of the interstitial tissue. The posterior nerve roots of the lower dorsal and lumbo-sacral regions showed likewise a slight rarefaction of myelin sheaths with corresponding interstitial thickening. Similar changes were observed in the lateral columns, especially in the marginal zones, but only involved the lumbo-sacral segments. Numerous corpora amylacea were present throughout the involved regions of the posterior and lateral columns. The cells of Clarke's columns were perfectly intact. Rossi, discussing the pathogeny of his case, eliminates without difficulty all possibility of congenital or of secondary sclerotic atrophy and concludes that the condition is one of primary parenchymatous cortical atrophy of the cerebellum.

Brouwer (25) recently reported a case in which lesions of the same general character as in the preceding observation were confined to one cerebellar hemisphere. The patient, a man of 30 years and a baker by occupation, died while working in overheated quarters. At the autopsy the left cerebellar hemisphere was enormously atrophied, being only one third the size of its fellow. The left occipital fossa was much smaller than the right. On the affected side the flocculus and the most anterior segment of the hemisphere were well developed. The corresponding corpus dentatum was markedly reduced in size. The inferior and middle cerebellar peduncles, the transverse pontine fiber strata, the striæ acusticæ and the antero-external arcuate fibers on the same side, and the inferior olive and ventral gray substance of the pons on the opposite side were all markedly atrophied. The superior cerebellar peduncle and the homolateral half of the cord were slightly diminished in size. There were no secondary degenerations and the

actual lesions were confined to the cerebellar cortex. The molecular zone was decidedly atrophied, the Purkinje cells almost entirely wanting, the granular layer enormously diseased and reduced to a thin layer of rather large cells. There was an associated hyperplasia of the neuroglial tissue. The author places his case under the heading of neo-cerebellar atrophy in the sense of Vogt and Astnazurow (60) and refers briefly to other cases of this type. The striking feature of Brouwer's case was that the patient had never exhibited any symptoms referable to the central nervous system.

#### PERSONAL OBSERVATION

The patient whose anatomo-clinical study inspired the present contribution was admitted to the County Hospital, Albany, N. Y., in 1905, at the age of 55, with pronounced evidence of organic nervous disease: titubation, oscillations of the trunk, tremor in the arms, etc. The records show, however, that he was not subjected to any systematic clinical examination until March 2, 1907. The history of the case is as follows:

Wm. S., male, age 57, farmer. He had had the ordinary diseases of childhood and among these an unusually severe scarlatina. He had received only a limited education at a country school, had exhibited particular fondness for arithmetic, had learned to read well enough, but never could write anything except the simplest sort of a letter. He never had used alcohol or tobacco to any extent and denied all venereal infection. Repeated Wassermann tests gave negative reactions. While he was a perfectly intelligent man, his memory seemed rather defective and he could only furnish scanty information regarding the actual date and mode of onset of his symptoms. Repeated questioning brought out the fact, however, that at the age of 17 he had a severe illness with fever continuing for several days and associated with pronounced gastro-intestinal disorders and marked prostration. He stated that during convalescence he was dizzy, staggered somewhat in walking and that his hands felt stiff and awkward. He rapidly recovered from these disturbances, although he claimed that ever thereafter he tired more easily at his work and that he never could control the movements of his hands as perfectly as before. This man, who never had any other occupation than farming, experienced very little annoyance from this residual disorder in the ordinary pursuit of his farming activities, but when he attempted to execute more delicate acts, movements requiring precision and sustained attention, he found that he was clumsy, that he overreached and that his hands became tremulous. This occurred, for instance, when he tried to set the hands of the clock, to sew a button on his trousers, to sign his name in the election register, to play cards or billiards

at the country hotel, etc. He gave an excellent description of these experiences and likewise stated that he slipped more easily than other individuals when walking on icy ground, that he was unsteady when he attempted to mount a horse or go up a ladder. Thus, this man seems to have presented, ever since his illness during youth, a permanent trace of defective cerebellar innervation. This was too slight to interfere with his work and it has been established through inquiries at his country home that he was a diligent, capable and reliable farm hand. He continued thus until about the age of 40, when he noticed that he was slowly becoming more and more insecure on his feet and awkward in the movements of his arms. He had to gradually simplify the nature of his work, to restrict himself to coarser undertakings, but he nevertheless continued to do some work for several years. In order to avoid unnecessary repetitions, it seems wiser to describe his various manifestations after they had reached their maximum intensity than to give the results of the various clinical examinations in chronologic order.

*Station and Gait.*—In the upright position the trunk was the seat of coarse antero-posterior and lateral oscillations, and the legs were slightly, not markedly, abducted. If the feet were brought close together the amplitude of the oscillations was much increased and the patient could not keep this position, but would fall unless someone stood on either side to hold him. This was accentuated by closure of the eyes, so that in reality Romberg's sign was present. In addition the trunk presented a very definite anterior inclination. This was not due to antelexion of the head nor to anterior incurvation of the thoracic segment of the vertebral column upon the lumbosacral segment with the consequent production of more or less kyphosis, but was due exclusively to flexion of the trunk as a whole upon the lower extremities, *i. e.*, the angle corresponded to a line passing through the hip-points. The vertebral axis was straight and the head fell in the same plane. The arms were slightly abducted or rather appeared so by reason of the semi-flexion of the forearms, the hands being on a level with and in front of the groins, thus necessarily displacing the elbows somewhat outward. It will thus be seen that owing to this position of the arms and the anterior inclination of the trunk, the appearance of this patient at the first glance recalled in a certain measure the attitude characteristic of paralysis agitans. The rigidity of the trunk and extremities later to be described further heightened the resemblance. The patient, however, in sitting down did not fall backward on the chair nor did he require to be pulled up to an erect position: he executed both changes readily enough, although he oscillated to an exaggerated degree in assuming the upright posture. In the seated position he preserved his trunkal antelexion, almost never resting the dorsum against the back of the chair. Whether the patient was standing or sitting, his head was the seat of a typical tremor, such as occurs in the more striking forms of multiple sclerosis, the tremor disappearing only when the head was supported or when he actually lay down and rested it upon the pillow. In walking, the whole ap-

pearance was most extraordinary. The patient with his forward inclination of the trunk actually pitched forward, no longer keeping the feet apart as in standing, but rather holding the legs adducted; each foot left the ground after a momentary hesitation, but was then abruptly lifted to an exaggerated degree, then replaced violently upon the ground. The hypermetria in this movement was extreme, the thigh forming with the trunk an angle of less than ninety degrees. Instead of taking rather short steps, as is usual in cerebellar cases, this patient took enormous strides and thus rapidly covered considerable ground, but the exercise quickly exhausted him and upon stopping he was breathless and far more unsteady than at the start. This long stepping was evidently the necessary consequence of both his excessive dysmetria and his antero-pulsion. In addition the patient did not walk a straight line, but described a sinuous course, the body being alternately carried too much to the right and too much to the left, so that he exhibited the classic titubation which characterizes the cerebellar gait. He gave a history of repeated falls, mainly as the result of stumbling against obstacles or projecting edges in poorly constructed sidewalks but on the whole falls were relatively infrequent. While he experienced no difficulty in going up a flight of stairs he was panic-stricken when he attempted to descend, feared that he would plunge forward and strike on his head and began to oscillate in all directions. Usually he came down sideways, holding on tightly to the banister if such was available, otherwise he requested some one to go down ahead of him and lend him support.

Lower extremities: There was no muscular weakness, the patient could execute spontaneously all the movements at the hip, knee and ankle, and he likewise opposed excellent resistance to any efforts at passive displacements. In fact, even when told to relax and allow manipulations at the joints, considerable resistance was encountered which could not be interpreted otherwise than as rigidity. This was particularly true for the adductors of the thighs and the flexors of the legs. The knee and ankle jerks were hyperactive, but there was no ankle clonus, no Babinski nor Oppenheim phenomena. The organic reflexes were undisturbed, save that a certain delay in micturition was occasionally present. The abdominal and cremasteric reflexes were present but weakened. In standing the patient, as previously stated, inclined the trunk forward. He very unwillingly went through the Babinski test of posterior inclination, as he dreaded a fall, but finally yielded when assured that two robust individuals stood behind him. He promptly fell back in their arms, not by reason of failure of compensatory flexion of the knees and feet, which he actually executed, but because he did not at the same time sufficiently extend the trunk and throw the abdomen forward. This test for asynergy was therefore only partly positive. On the other hand when, in the standing posture and properly supported, he was asked to place the foot on a chair in front of him he showed no asynergy and executed the movement perfectly. In the dorsal decubitus with arms folded on



his chest he was able to sit up, but invariably flexed the thighs on the pelvis and the legs on the thighs. When in this same position he was told to place one heel on the opposite knee, the thigh was hyperflexed and the heel abruptly carried to a point about midway between the knee and the pubic symphysis on the adductor aspect of the thigh and then slowly lowered until it rested upon the patella. In reality this was a mixture of hypermetria and asynergy and it was more marked on the right than on the left side. When the patient was asked to elevate the lower extremity and touch with the big toe the handle of a reflex hammer held by the examiner at a height of about eight or ten inches above the level of the bed, the foot was not only first carried to a point distinctly beyond the object but the whole limb developed an increasing coarse tremor or oscillation analogous to that observed in multiple sclerosis. It was far more pronounced in the right leg than in the left. In neither of the two latter tests did the suppression of sight materially augment the intensity of the disorder. Tests for diadochokinesis in the lower extremities showed no significant disturbance. On the contrary in the test proposed by Babinski for the display of cerebellar catalepsy (dorsal decubitus with thighs flexed on pelvis, legs partly flexed on thighs and at the same time abducted) the patient first exhibited wide lateral oscillations of the lower extremities then gradually assumed a state of immobility or wax-like fixity which persisted fully ten minutes. This manifestation appeared in all its particulars with the same perfection that characterized it in some of Babinski's patients whom I saw.

Upper extremities: As in the lower extremities there was not the slightest evidence of muscular weakness, but some rigidity or exaltation of muscle tone was present in certain muscular groups, more especially in the pronators of the forearm and hand, in the flexors of the forearms, to a lesser degree in the adductors of the arm. Sensation was intact and the tendon reflexes were very active, but practically equal on the two sides. If the patient was asked to place the tip of the index finger on the tip of the nose, the orientation of the movement was perfect, the finger touched the tip of the nose, but did not stop there, being carried beyond and usually to the distal side, then brought back in place. At the same time an intention tremor absolutely similar to that of multiple sclerosis began to appear as the finger neared its goal. The whole manifestation differed materially according as the movement was executed rapidly or slowly. The more rapid the movement the greater was the dysmetria and the less marked the tremor; inversely the slower the movement the less evident became the dysmetria and the more accentuated the tremor. This peculiarity has already been brought out by Thomas in a well-reported case (6). The disorder was practically the same whether the eyes were open or closed and was more severe in the right arm than in the left. In filling a glass with water from a flask held by the right hand the patient poured the liquid to one side. Similarly, if the glass was filled for him and he was requested to carry it to his lips, the arm rapidly de-

veloped increasing oscillations and the water was spilled all over his clothes. There was likewise definite adiadochokinesis in both arms, more marked on the right side despite the fact that this man was right-handed. The defect was hardly apparent during rapid flexion and extension of the forearm on the arm, but was striking in the more usual test of alternate pronation and supination. Not only was the movement as a whole executed more slowly than by a normal individual, but a definite pause intervened between the two components of the act and pronation was more rapid and ample than supination. The patient was totally unable to write even the simplest words, not even his own name, by reason of the tremor which assumed extraordinary intensity the moment any such delicate act was contemplated. Asked to trace a circle, a square or a rectangle, the patient executed the most irregular and grotesque patterns.

Face: There was no facial weakness, although the isolated closure of the right eye was impossible, but there did exist a peculiar rigidity of the facial musculature which gave this patient a distinctive physiognomy. It is frequently stated that in cerebellar disease the face is expressionless, that the eyes stare in a dull blank fashion. In this case, on the contrary, the features were contracted in a permanent expression of good humor and pleasant disposition. The transverse furrows on the forehead were deepened, the eyebrows elevated, the palpebral fissures narrowed and the corners of the mouth somewhat elevated so that the patient constantly exhibited a smiling countenance tinged with a certain admixture of sarcasm. This was so true that he was called by his fellow patients "smiling Bill." The tongue was protruded without difficulty, but presented a trace of intention tremor and was occasionally rapidly retracted and as suddenly protruded again. There was an imperfect elevation of the velum palati upon efforts at phonation. The pharyngeal and masseteric reflexes were normal. The speech was slowed, monotonous, with occasional pauses, but without definite scanning. The voice had a very distinct nasal intonation and the patient was unable to emit loud sounds or to shout. There was no dysarthria for the ordinary words and the man's limited education rendered the repetition of long and difficult words a meaningless test. He never showed any evidence of dysphagia or of dysmnesia. There was no restriction of ocular excursion in any direction, but when the eyeballs were carried in the horizontal plane from one side to the other there were definite breaks or interruptions in the excursion, *i. e.*, the movement was discontinuous. This amounted to coarse nystagmic shocks rather than to true nystagmus and might be interpreted either as a tremor of the ocular muscles or perhaps as a manifestation of asynergy. The pupils reacted perfectly to light and to accommodation and convergence efforts. The eye grounds showed slightly congested vessels and some imprecision of disc outline but these findings were not regarded as significant by the oculist. A slight degree of deafness was present on both sides, but repeated examinations by a competent otologist

yielded practically normal ear findings. There was no sensory disturbance in the domain of the trigeminal and taste and smell were intact.

Induced nystagmus and pointing reactions: Turning tests yielded normal nystagmic reactions and the head swayed to the right or to the left according as the patient was rotated to the right or to the left. As regards the pointing reactions after such tests, rotation so greatly intensified the dysmetria and the intention tremor that no satisfactory conclusion could be reached. The tests for spontaneous deviation of the index devised by Bárány (19-22) were far more serviceable, though likewise rather inconclusive in a patient already presenting such pronounced perturbation of all his spontaneous activities. However, as far as could be ascertained, despite the dysmetria and the coarse oscillation of the extremities and judging more particularly from the general orientation of the movement from the very start, it seemed that either upper extremity deviated definitely inward or mesially when the patient pointed from above downward and deviated downward when he pointed from without inward. The error was far less evident when he pointed from below upward or from within outward. The caloric test was not tried largely because of the patient's opposition; he was convinced that a previous irrigation for the removal of cerumen had increased his deafness.

Atonia and asthenia: While this patient was still under observation, some of the recent publications of Thomas (11-14) had already appeared and it was decided to submit this man to the various tests invented by Thomas in his effort to elucidate the genesis of the peculiar abnormal positions and attitudes so frequently observed in cases of cerebellar lesions. Thomas, having in mind the abnormal positions of the limbs of the dog after experimental resections of the cerebellum and likewise the failure to correct or at least the delayed correction of abnormal attitudes passively produced, has tried to demonstrate that many of the peculiar and abnormal attitudes of cerebellar patients are comparable in a certain measure to the experimental facts and that they are due to loss of the normal reciprocal fluctuations in the tonus or sthenic state of antagonistic muscle groups. In fact he has shown fairly conclusively in a number of very recently reported cases (11-16) that in cerebellar disease the unusual attitudes of the trunk or the abnormal positions of the extremities are due to the predominant activity of certain muscular groups over their antagonists and that the cause of this predominance resides in an inherent hypertonia or hypersthenia which manifests itself in all movements whether active, passive, automatic or reflex. He prefers to speak of hypersthenia and hyposthenia rather than of hypertonia and hypotonia, owing to the fact that the term atonia or hypotonia has been employed mainly to indicate flabbiness of the musculature with relaxation of tendons permitting abnormal mobility at the joints, a condition which never obtains in purely cerebellar lesions. This combination of hypersthenia of certain muscle groups and

hyposthenia of their antagonists Thomas designated as "anisthenia" (*i. e.*, unequal force). The patient whose clinical manifestations have just been described presented a number of muscular reactions which serve to substantiate the claims of Thomas. Following the method employed by this author and without relating here the full detail of the various tests, which would be superfluous, I shall confine myself to a few of the more significant results. If the patient seated on a chair without a back straightened himself and held the trunk erect or if this correction was passively enforced he would maintain the attitude only a few moments and then gradually resume his strong anteflexion. Seized by the shoulders with both hands and alternately pushed forward and pulled backward, forward displacement required little effort, whereas backward displacement encountered enormous resistance. Suddenly jostled from behind he would almost fall on his knees, whereas when a similar push was delivered from in front he barely moved backward. This indicated a hypersthenia or hypertonia of the flexors of the trunk and pelvis upon the thighs (*psaos-iliacus*, *rectus femoris*, *sartorius*, etc.). It was unquestionably this same hypersthenia of the *psaos-iliacus* particularly which was responsible for the perfect cerebellar catalepsy which he exhibited. A similar imbalance of muscle tone was demonstrable in the extremities. When the patient was lying down with lower extremities fully extended, the knees were usually adducted and the feet held midway between adduction and abduction instead of in mild abduction. The patient being instructed to remain entirely passive and relaxed and the limbs placed in slight abduction, if the foot on either side was carried into extreme abduction it promptly returned to its original position, whereas carried into extreme adduction it resumed its usual position much more slowly. Placed in the attitude employed for cerebellar catalepsy and after the initial oscillations had subsided, if the knees were alternately widely separated and closely approximated and then left in marked abduction they quickly returned to almost complete adduction. On the contrary if they were abandoned in contact with each other they secondarily assumed slowly the moderate degree of abduction in which they had originally been placed. Identical behavior was found in the musculature of the upper extremities. The patient being seated with hands resting on the knees and fingers extended, alternate pronation and supination slowly executed showed decided disproportion. Pronation was rapid and complete, whereas supination was much slower and abortive. The Stewart-Holmes test (failure of extensor rebound when resistance to energetic flexion of the forearm is suddenly withdrawn) gave a distinctly positive result in this case and the same manœuvre applied to the adductors of the arm yielded a similar reaction. If the arm was first moderately abducted and semi-flexed and the patient was instructed to strongly adduct it while resistance was firmly applied at the elbow there was practically no abductor rebound when resistance was suddenly removed. The same thing occurred with regard to the flexors of the

leg, but was less pronounced. Thomas has admitted that the Stewart-Holmes test was practically analogous to the various tests proposed by him and that it serves to illustrate essentially the same phenomenon, namely the sthenic imbalance of the antagonists. It should be repeated, however, that this does not depend upon obvious inequality of muscular power; there was no definite weakness, properly speaking, of certain muscle groups compared with others. When the patient executed various movements there was no trace of limitation in the excursion of the limbs or segments of limbs, and when asked to resist segmental displacements of the extremities he did so remarkably well and without any appreciable difference between the various antagonistic groups. Supination, it is true, was incomplete and the abductors of the thighs were perhaps less potent than in normal individuals but this was hardly sufficiently marked to legitimate the use of the term "asthenia." It is not believed that actual motor weakness is a symptom of cerebellar disease. There was thus in this patient a prevalence of flexor, pronator and adductor, attitudes and this prevalence revealed itself not only during active and passive movements but likewise in the exhibition of hypermetria, asynergy, catalepsy and spontaneous deviation. His condition remained practically unchanged during the several years of his hospitalization, except for the gradual intensification of his anteropulsion, his hypermetria and his intention tremor, until he contracted lobar pneumonia, from which he died May 29, 1915. The diagnosis of multiple sclerosis had been made from the start and this diagnosis remained unchanged. It was simply believed that in this case the foci of sclerosis involved in preponderant fashion the cerebellum and its afferent and efferent tracts. The presence of definite rigidity, the much weakened abdominal reflexes, the increased tendon reflexes, the occurrence of even atypical nystagmus, the congested eye-grounds and the jovial physiognomy were all elements which combined to lead us into error. It is recognized that there are many clinical analogies between multiple sclerosis and the degenerative atrophies of the cerebellum and that the differentiation of the two diseases is often extremely difficult. Dejerine and Thomas (3, 29) in particular have repeatedly called attention to this fact. In looking over the literature of this subject one finds that in a large number of instances cerebellar atrophy had been diagnosticated as multiple sclerosis.

#### ANATOMIC EXAMINATION

Macroscopically the only peculiarity noted was the diminutive size of the cerebellum, which showed a generalized and practically symmetrical atrophy with practically perfect conservation of external configuration, except that on the dorsal surface the greatest prominence did not correspond as it does normally to the vermis (culmen), but was distinctly deviated to the left. The greatest transverse diameter of the cerebellum was 7 cm.; the greatest antero-posterior diameter of the hemispheres was 4.5 cm.; the greatest depth (measured on mounted serial sections) was 2.5 cm.

for the vermis, 3.5 cm. for the right hemisphere and 4 cm. for the left hemisphere. Even admitting the considerable variations in the size of normal cerebella, it will be seen that by comparison with the measurements specified in standard works on anatomy, the volume of the cerebellum in this case was reduced a trifle less than one third. The leptomeninges of the cerebellum were not thickened nor adherent to the cortex and were everywhere stripped away

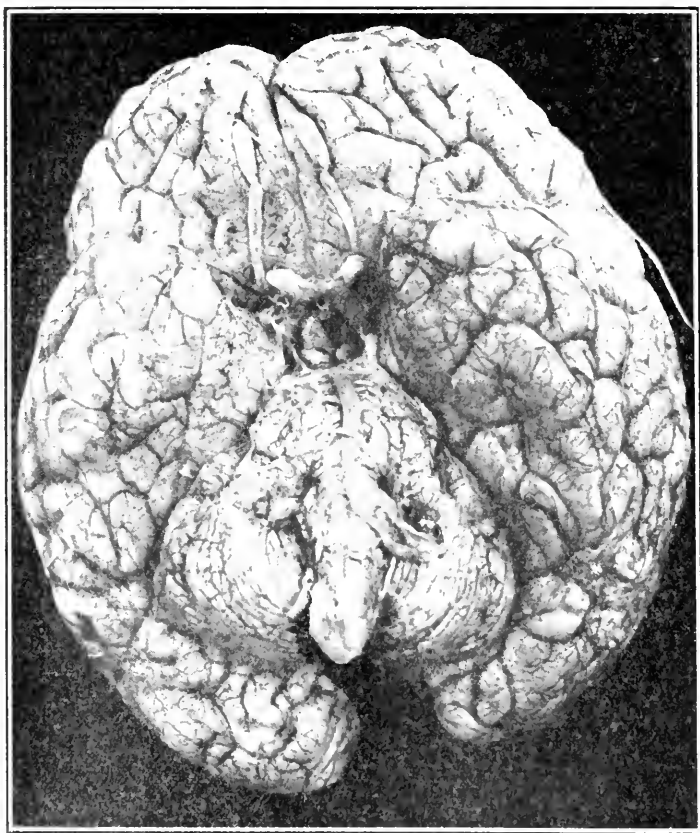


FIG. 1. Showing generalized atrophy of Cerebellum and, unusual delimitation of the lobules.

without difficulty. This being done it was more easily seen that the superficial sulci were widened and the lamellae appreciably narrower than in the normal state. This lamellar atrophy was more or less generalized but particularly evident in the superior vermis, the quadrangular and digastric lobules. The main fissures or interlobular sulci were unusually distinct, so that the various lobules were more sharply defined than in the normal state. This detail is fairly apparent in the first illustration of this case (Fig. 1).

The bulb was perhaps slightly reduced in size and the olives less prominent than usual. The cerebral hemispheres presented no abnormalities, save that the left hemisphere was a trifle shorter than the right and that by comparison with several normal brains the relative size of the frontal lobes seemed inferior to the normal. This appeared to be due to a generalized reduction in volume, the sulci were not enlarged nor the convolutions narrowed and the cortex presented no changes. Frontal sections through the cerebral hemispheres revealed perfectly normal findings throughout. The cord likewise was entirely negative. The brain-stem was examined by means of serial sections all the way from the posterior wall of the third ventricle to the motor crossway. One series was stained according to the Weigert method and another according to the Weigert-Pal modification. At varying levels unusually thin sections were obtained, flattened out on tissue paper and then the individual lobules or segments of these lobules were cut away for the more detailed study of the histological changes within the cortex.

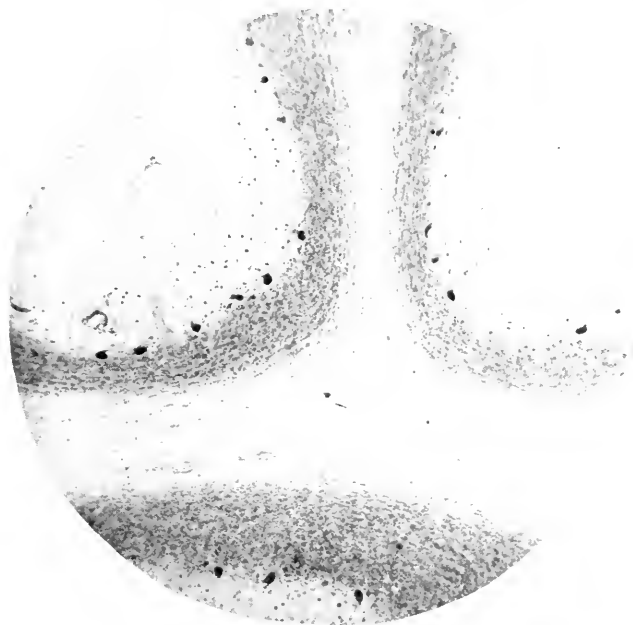


FIG. 2. Cortex of normal Cerebellum showing almost unbroken row of Purkinje cells.

In addition small fragments of the cortex had been removed in the fresh state from the anterior extremity of the superior worm and from the anterior and posterior borders of the hemispheres and specially prepared for cell-stains. It was thus possible, with the further help derived from the Weigert series, to ascertain in a fairly satisfactory fashion not only the nature and severity of the cortical lesions, but likewise the topographic variations in their in-

tensity. The finer and smaller sections were stained with hematein-eosin, Van Gieson's solution, phosphotungstic acid—hematoxylin and even with thionin. Blocks from the various levels of the cord from the first cervical segment to the sacral enlargement were likewise prepared and sections from each level stained with the Weigert and Pal methods.

Lesions were found exclusively in the cerebellar cortex, there were no secondary degenerations and only insignificant secondary atrophies. The lesions in point of character are practically identical with those so well described by Rossi in his case, but they are far more severe and generalized. It may be stated at once that normal cerebellar cortex is nowhere to be found; in every part of the cortex well-marked changes are present and the only tedious part of the task has been to repeatedly examine the series of sections in order to accurately determine the topographic gradations in the severity of the lesions. In a general way the lesions are distinctly more marked in the lobules of the superior or dorsal surface than in the lobules of the ventral surface and this is particularly true of the superior worm which is much more severely involved than the



FIG. 3. Section from less severely involved region of cortex showing two persisting but much atrophied Purkinje cells.

inferior worm; they are more marked in the anterior than in the posterior half of the cerebellum except as regards the superior worm in which the changes reach their maximum intensity in the declive; they are more marked in the right than in the left hemisphere and in both hemispheres the lateral or external lamellae are more dis-



ceased than the median lamellæ, the only exception to this being the median lamellæ on the dorsal surface of the hemispheres, which are quite as extensively implicated as are the adjoining lamellæ of the vermis. In practically every lobule the superficial lamellæ are more profoundly altered than are the deeper lamellæ. The most extreme changes are found in the superior worm, the quadrangular lobules and the external segments of the digastric lobules. Less severely involved are the semilunar and gracile lobules, the flocculi, the uvula and the nodule. Least involved of all are the pyramid, the tonsils and the mesial segments of the digastric lobules, but as previously stated pronounced changes are encountered throughout the entire cortex. As in the case reported by Rossi all three layers of the cortex are diseased in the most involved areas and practically to an equal degree. In less intensely affected lobules or groups of lamellæ the changes are either as diffuse but less severe or else confined to the molecular zone and to the layer of Purkinje cells, while in the least compromised regions the changes are almost exclusively limited to the Purkinje cells.

Cerebellar cortex: The lesions observed in the most markedly atrophied lobules (superior worm and quadrangular lobules) are very characteristic. The molecular zone is greatly narrowed, frequently reduced to one half or even one third its normal width and this is particularly striking over the crests of the folia (Fig. 4); the dendrites of the Purkinje cells are totally wanting and a moderate proliferation of glia cells has taken place. The overlying pia mater (or the delicate folds of the pia intercalated between the folia) is not thickened, but in certain places it contains a few disseminated round cells resembling lymphocytes. The vessels within the pia are more numerous than normal, have markedly thickened walls, but are neither obliterated nor the seat of cellular infiltration. They are merely distended with red blood cells and surrounded in many places by a peculiar homogeneous and gelatinous substance (terminal edema or encysted cerebro-spinal fluid?). There are no actual vascular foci within the cortex, not even the most minute areas of softening, but in many places, nevertheless, particularly where the cortex has undergone maximum atrophy (vermis superior), the molecular layer appears indented, eroded and undermined (Fig. 7). Corpora amylacea are present at various points within the molecular zone; they are not numerous and are located mainly beneath the pia mater.

The Purkinje cells exhibit the most diverse changes. Whole segments of the cortex are totally devoid of them, while other segments or groups of lamellæ contain a few scattered ones and still other segments have retained them in fair numbers. In no part of the cortex, however, are perfectly normal Purkinje cells to be seen; wherever they occur they present very marked structural changes. In the more seriously diseased lamellæ still containing them these cells appear merely as shadows, as more or less rounded homogeneous vesicles devoid of all cell structure and processes and taking but a feeble stain. In the relatively least involved lamellæ

(tonsils, pyramid) the Purkinje cells are far less numerous than normal, those which persist are atrophic, more or less deformed, have an ill-differentiated cell structure without evident nuclei (Fig. 3), take a diffuse stain and possess stunted and narrowed dendritic processes. In many places where the Purkinje cells have entirely disappeared, their places are not filled in by neuroglial cell nests or fibrillar networks as in Thomas's case of lamellar atrophy, but

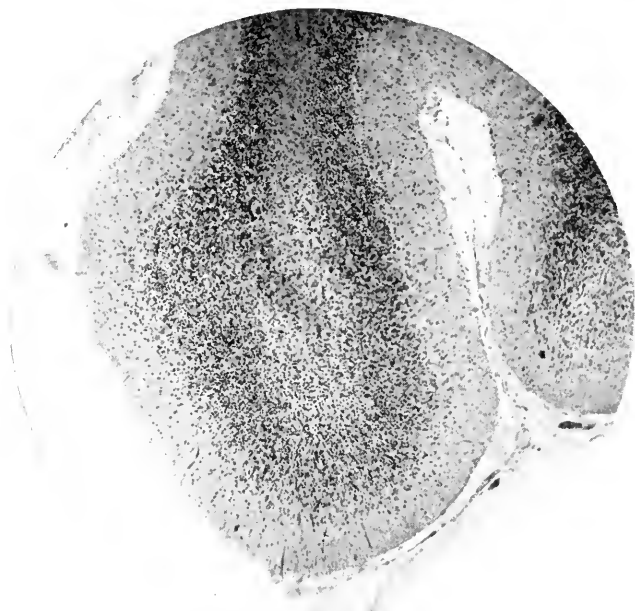


FIG. 4. Lamella from superior vermis showing marked narrowing of molecular zone, total absence of Purkinje cells and rarefaction of granular layer.

the entire plane normally occupied by the single row of closely approximated Purkinje cells (Fig. 2) is transformed into a clear unstaining almost structureless and partly cribriform zone. This is particularly noticeable at the summit of the folia and gives the impression of actual cleavage or fissuring at the junction of the molecular and granular layers (Fig. 5, 6).

The granular layer is much reduced in width and presents in addition a markedly rarefied appearance. This is due to the disappearance of large numbers of granules particularly towards the crests of the folia. The granular cells are no longer closely packed, but distributed in relatively loose fashion, so that the individual cells can be studied without difficulty. They are not reduced in size, though they are not of uniform dimension, stain very poorly with all the nuclear stains and have scattered among them only moderate numbers of glia cells.

The fiber fasciculi forming the core of the lamellae are not degenerated; they are simply less robust than in the normal state.

The terminal tufts occupying the crests of the folia, however, are more seriously compromised. In many folia there is a very noticeable and abrupt rarefaction of the axial medullary substance and pronounced discoloration or degeneration of the terminal irradiating fibers (Fig. 7). In most lamellæ, however, the intracortical fiber network is remarkably preserved and this is true even of the finer horizontally coursing fibrils of the Purkinje layer.

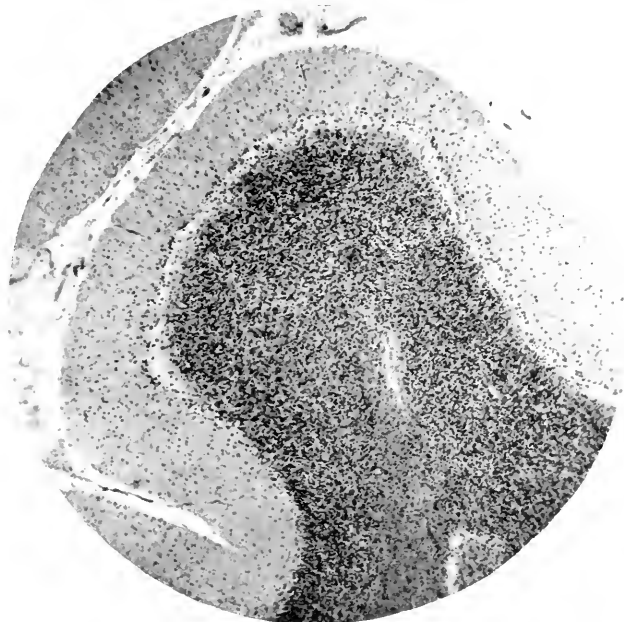


FIG. 5. The total destruction of the Purkinje cells gives the impression of actual cleavage at the junction of the molecular and granular zones.

Such are the changes encountered in the most atrophied lobules and lamellæ. As above stated, in the less severely affected regions the lesions are similar but of milder grade or else involve mainly the molecular zone and the Purkinje cells, the granular layer being relatively undisturbed, while in the healthiest lobules and lamellæ the cortical changes are almost strictly confined to the Purkinje cells. The only constant finding therefore is the total disappearance or extreme degeneration of the Purkinje cell. This is not to be wondered at when it is remembered that the enormous tree-like arborizations of these cells occupy such preponderant place in the molecular zone and that the slightest injury to this zone is bound to reach them. Injury to any part of the neuron reacts upon that neuron in its entirety and it is therefore easy to conceive that inasmuch as the cortex receives its blood-supply from the pia mater, progressive starvation and atrophy of the Purkinje cells is the natural outcome of the slowly increasing atresia of the pial arterioles.

Subcortex and central ganglia: The large sections (Fig. 8-10) passing through the cerebellum and pons show a decided asymmetry between the two lateral halves of the cerebellum. As the result evidently of the preponderant atrophy of the right hemisphere

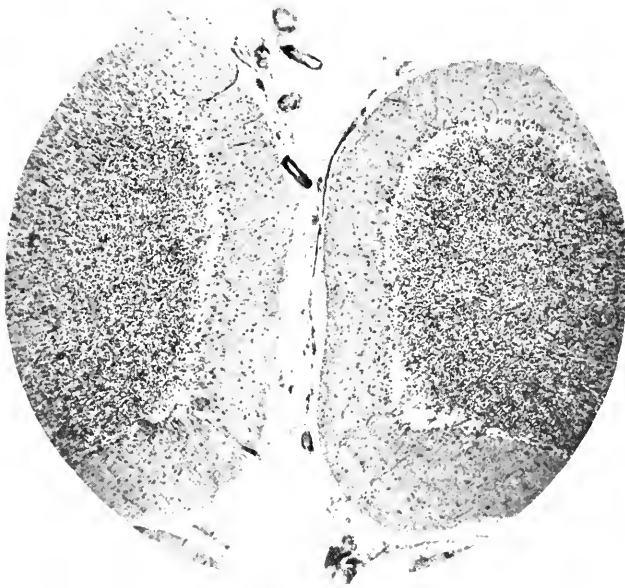


FIG. 6. Shows the same features as preceding figure and also the thickened blood vessels in the pia mater.

and vermis, the left hemisphere seems to be somewhat dislocated upward and all the central structures of this hemisphere (corpus dentatum, external semicircular fasciculi, brachium conjunctivum, etc.) are located on a slightly higher level than the corresponding structures of the right hemisphere. Even the left nucleus tecti is on a higher plane than the right (Fig. 9). The narrowed lamellæ and folia and the widened sulci are distinctly apparent in the superior worm and in the quadrangular lobules. The deep white matter of the hemispheres is not degenerated, although it seems to be rather pallid, largely as the result of excessive differentiation during the process of staining. The right corpus dentatum appears first because the sections do not pass on both sides through strictly corresponding antero-posterior levels, the right hemisphere being engaged in advance of the left. The corpora dentata are somewhat diminished in size when compared with the corpora dentata of a normal series employed for purposes of control. This general reduction in volume is not abnormal, but directly proportionate to the cortical atrophy of the hemispheres. The constituting blade of gray matter is slightly narrower than normal, its infoldings are less deep, but on the other hand its cells are numerous and exhibit no

degenerative changes. The only material abnormality in this connection is the very distinct discoloration of the fiber zone bordering upon the lateral aspect of the corpus dentatum and dipping down into its lateral diverticula. This feebly staining vertical zone offers on either side a striking contrast to the robust and deeply stained fasciculi of the brachium conjunctivum emerging from the mesial



FIG. 7. Section of cortex of the Culmen showing erosion of the molecular zone and degeneration of the axial medullary substance.

aspect of the corpus dentatum. On the other hand this pallid area does not present microscopically definite evidence of degeneration, the fibers are simply thinned and less closely aggregated than in the outlying white matter. The slit in the brachium conjunctivum on either side is an artifact and resulted from undue traction upon the bulb when this part was separated from the pons in the fresh state. This regrettable error of technique has not interfered, however, with the correct interpretation of the findings. The external semicircular fibers are well developed and can be followed to the lamellæ of the superior worm. The fibers of the internal semicircular fiber-system (Fig. 8) are likewise normal and form a robust decussating field in the deep portion of the vermis immediately above the roof of the ventricle. The nuclei of the roof (nuclei tecti) are well represented (Fig. 9), perhaps a trifle smaller than normal, but contain anteriorly numerous normal-looking cells. Posteriorly (Fig. 10), however, they are surrounded and permeated by distinctly pale-staining fibers and have all the appearances of actual degeneration. The nucleus globosus and the

nucleus emboliformis (Fig. 9, 10) on either side are well developed and appear perfectly normal. The ependyma lining the roof of the fourth ventricle is somewhat thickened and the small vascular twigs forming the choroid plexus have thickened walls. The same is true of the blood vessels in the pial process extending on either side between the uvula and the tonsil. In the lower part of the section the right half of the pons is definitely smaller than the left in keeping with the more extensive involvement of the right cerebellar hemisphere. The brachium pontis appears somewhat feebly stained, but the Weigert series shows that there is no evidence of degeneration and that the cells of the ventral segment of the pons are perfectly normal. The central tegmental or thalamo-olivary tracts are unusually well developed, rather more so than in the normal brain-stem and the same is true of the dorsal longitudinal bundles of Schütz. All the other structures in the pons appear absolutely normal in every respect.

Mid-brain: Sections through this segment of the brain-stem show practically normal conditions. The red nuclei are well developed and present no degenerative changes. The marginal layer of the corpora quadrigemina appears somewhat pallid, possibly as the result of the vascular thickening seen in the overlying pia mater. In fact the pia at this point presents the same changes as those already described in connection with the folds contained between the cerebellar folia and this may account for the patient's slight impairment of hearing. The crura present on either side a slight relative pallor of their most mesial segment, corresponding to the domain of the fronto-ponto-cerebellar tract.

Bulb: The sections through the various levels of the medulla seem somewhat smaller generally than normal sections. The central portion of the restiform bodies (area occupied mainly by the direct cerebellar tract) appears less deeply stained than the lateral segment, but this relative discoloration is very slight. The mesial division of the restiform bodies, *i. e.*, the domain of the direct sensory cerebellar tract of Edinger and of the nuclei of Deiters and Bechterew is absolutely intact. The inferior olives are the only structures in the medulla which exhibit appreciable though unimportant changes. They appear to have undergone a slight generalized reduction in volume, being more widely separated from each other mesially and bulging less markedly on the lateral surface than in the normal state. This atrophy is more evident in the inferior than in the superior half of the olive. The constituting blade of gray matter is slightly narrowed and its serrated infoldings describe a less tortuous course than in the normal state, but on the other hand it is richly supplied with well-staining and apparently normal cells. The olivo-cerebellar system is formed throughout of deeply staining fasciculi (retro- and inter-trigeminal) and permeates the various segments of the olive in the usual fashion, but it is less robust and the stratum zonale of the olives is consequently thinner than in normal sections. The fibers emerging from the hilus of the olive on either side form a compact deeply stained

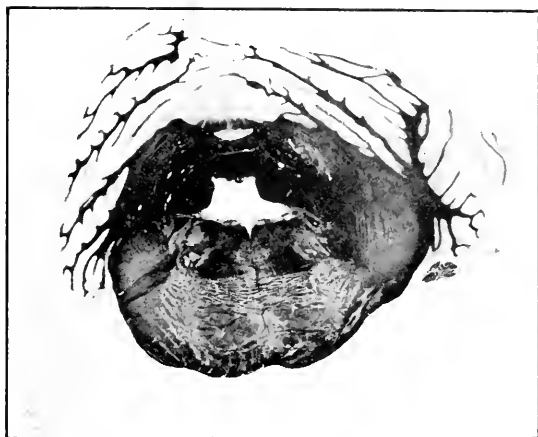


FIG. 8. Section through the anterior extremity of the right corpus dentatum and the trigeminal level of the pons. Peculiar asymmetry of the hemispherical lobules.

bundle. The accessory olivary bodies, the nuclei of the lateral columns, the arcuate nuclei and the antero-external and postero-external arcuate fiber systems as well as the nuclei of the posterior columns are all perfectly normal. At the lateral margin of the lower medulla on both sides the domain of the dorsal spino-cerebellar tract is less deeply stained than the surrounding white matter, though definite evidence of degeneration is wanting. In the meninges covering the lateral aspect of the bulb, the blood vessels have decidedly thickened walls, and this is likewise true of the vascular



FIG. 9. Section through the corpora dentata and the nuclei tecti. Vertical asymmetry of all the paired structures. Definite area of discoloration along the lateral aspect of the corpus dentatum more marked on the right side.

twigs found in the olivary bodies and in the gray matter surrounding the upper extremity of the central canal.

Spinal cord: Sections through the various levels of the spinal cord show practically normal conditions. There are no degenerative scleroses in the white columns and no cellular alterations

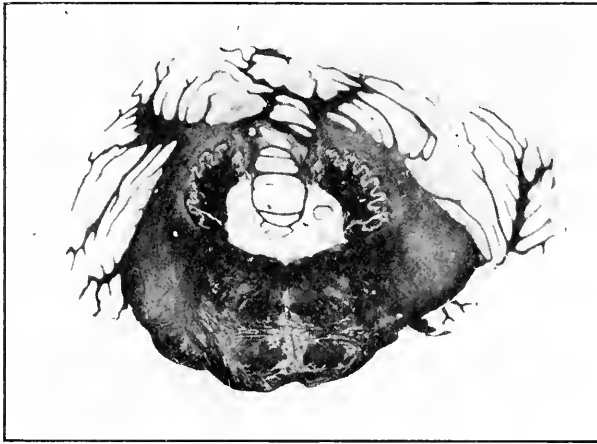


FIG. 10. Section through level of maximum development of corpora dentata and nuclei globosi. Discoloration again appears along lateral surface of the corpus dentatum and also in the central white matter of the vermis.

in the gray matter. Even the cells of the columns of Clarke exhibit no volumetric or structural modifications. The only peculiarity noted concerns the relatively unequal staining reaction of the constituent bundles of the posterior columns in the cervical region; the columns of Goll being less deeply colored than the columns of Burdach. Similarly in the upper dorsal region the marginal zone of the lateral columns, corresponding to the domain of the direct cerebellar tract, seems somewhat paler than the adjacent area of the crossed pyramidal tract. These relative discolorations, however, are extremely faint, and probably simply represent slight retrograde atrophies, as there is no evidence of degeneration with any of the ordinary staining methods. The vessels of the spinal cord and meninges also show thickening, but to a much lesser degree than the vessels of the cerebellar pia.

#### SUMMARY AND INTERPRETATION

A patient, who in his youth had presented an evanescent cerebellar syndrome presumably on the basis of a general infection, began to develop after the age of forty a slowly progressive dis-equilibration of station, gait and all voluntary movements of the extremities. His various symptoms, fully detailed above, realized in time the most severe and complete clinical picture of disordered



cerebellar function. Anatomically, degenerative lesions are strictly confined to the cerebellar cortex, there are no material secondary degenerations and the insignificant secondary atrophies observed in the central nuclei of the cerebellum, the olivary bodies and olivocerebellar system, the domain of the direct cerebellar tracts and columns of Goll, cannot be regarded as due to associated lesions but simply as slight retrograde atrophies. The lesions in the cerebellar folia are so severe and generalized that they are practically equivalent to a total suppression of the cerebellar cortex. They are more intense in the dorsal than in the ventral lobules, in the right than in the left hemisphere. In the majority of the lamellæ the degenerative changes involve all three layers of the cortex, but in a few lobules or segments of lobules they are practically confined to the layer of Purkinje cells. The disappearance or advanced degeneration of the Purkinje cells is therefore the predominating and only constant feature of this process of progressive cortical disintegration. The occurrence of a pathologic state characterized by such pronounced alterations strictly limited to the cerebellar cortex is in itself of extreme interest. Equally remarkable is the fact that the exclusive involvement of the cortex should have given rise to such severe and widespread functional disturbances. What is the pathogenesis of this peculiar degenerative atrophy of the cerebellar cortex? The cases of this kind which have been published by Thomas, Dejerine and Thomas, Murri, and Rossi, presented practically identical cortical changes, but have been regarded as instances of primary parenchymatous atrophy not dependent upon vascular changes and evolving without associated neuroglial hyperplasia. It is specifically stated in these various observations that there were no material vascular and neuroglial changes, although in Thomas's case it is mentioned that the Purkinje cells were replaced by a definite neuroglial felt-work and the patient moreover was syphilitic. In the present case vascular foci are wanting, but throughout the cerebellar leptomeninges the blood vessels have markedly thickened walls, occasional discrete cellular infiltrations are encountered and the molecular zone in certain places appears abraded and fissured. Perhaps these changes would be regarded by other observers as insufficient to account for the widespread degenerative lesions of the cortex and this case put on record as another instance of primary parenchymatous atrophy. This does not appear legitimate to me, however, and I cannot help but feel that the vascular thickening is at least partly responsible for the cortical atrophy. It is not necessary that severe meningo-vascular

changes should be present in order to observe secondary degenerative changes in the cerebellar cortex. The nutrition of the cortex is dependent upon the integrity of the vessels coursing in the overlying pia mater and is necessarily compromised the moment that irrigation becomes inadequate by reason of progressive thickening and atresia of these same vessels. The molecular zone is the first to suffer, but need not be materially implicated before serious damage has already been inflicted upon the layer of Purkinje cells. As previously stated, the arborescent dendritic fields of these cells occupy enormous space within the molecular zone and register at once the slightest encroachment upon this zone. It is therefore believed that in the genesis of cortical parenchymatous atrophy of the cerebellum, sclerosis of the meningeal vessels plays an important part. While a different view is held by other observers, the reliability and accuracy of whose statements concerning the condition of the blood vessels cannot possibly be doubted, it may be said that in lesions of this type there is ample room for contradictory interpretations. Is it not a significant fact that in the majority of cases of cerebellar atrophy thus far reported, the condition was either accompanied by actual meningo-vascular changes or else observed in patients who had reached an advanced age? In publishing his case of "lamellar atrophy of the Purkinje cells," Thomas stated that he had observed similar though much less pronounced cortical changes in the cerebellum of cases of tabes and multiple sclerosis, *i. e.*, two diseases in which we know that the blood vessels of the cerebro-spinal axis present undeniable and well-marked alterations. In our case, the patient had had, at the age of 17, transitory cerebellar manifestations following acute systemic infection and one instinctively thinks of the possibility of a mild poliomyelitis with predominating cerebellar localization. The above-quoted case of Thomas had had poliomyelitis in childhood and the lumbo-sacral cord bore the cicatrix of this lesion. The question therefore arises whether such initial and clinically recoverable vascular invasions of the cerebro-spinal axis cannot leave behind them regional vascular predispositions to subsequent toxæmia or infection. One would at least expect that with the later advent of arteriosclerosis, the areas of the central nervous system thus previously debilitated would succumb sooner and more rapidly than the hitherto undisturbed regions. This hypothesis would explain many features of tardy atrophy of the cerebellum which otherwise remain difficult to interpret.

The majority of the symptoms observed in our patient presented

no strikingly unusual features; they were the same symptoms that have been described over and over again in connection with disease of the cerebellum. An exception should be made, however, with regard to the strong antelexion of the trunk, the definite anteropulsion and the distinct rigidity more particularly of the trunk and lower extremities. These or analogous symptoms are very rarely mentioned in the literature of the cerebellum and its fiber-paths and only in connection with lesions involving other structures besides the cerebellum, notably the pyramidal tracts. In our case not only the pyramidal tracts but the entire cord, bulb, pons and mid-brain are intact so that we must admit that all of the patient's clinical manifestations resulted from the isolated involvement of the cerebellum. While it is hardly justifiable to formulate any positive conclusion merely from the observation of a single case, the clinical findings in this patient were so definite and invariable, the anatomic lesions so well characterized and topographically limited, that one may legitimately further assume that the various functional disturbances were essentially symptomatic of cortical deficit. This case, therefore, is of considerable value in affirming the genuine intrinsic character of many cerebellar symptoms and incidentally serves to demonstrate that the symptoms described by Babinski, more particularly adiadochokinesis, asynergy and cerebellar catalepsy, are truly manifestations of disordered cerebellar function.

An attempt to correlate the more striking functional losses with the greater focal involvement of certain regions of the cortex is a more difficult task. *A priori* it would seem both hazardous and unjustified to submit any suggestions regarding cerebellar localization from the study of a case presenting such generalized lesions of the cortex. However, there are sufficient topographic differences in the severity of the process to warrant certain reflections and by reason of the nature of the lesion this case is far more serviceable than are tumor cases. There can be no doubt, of course, that the greater involvement of the right cerebellar hemisphere explains the more severe functional disorders in the extremities on the right side. The explanation of the predominating flexor and adductor attitudes of the extremities might perhaps be found in the definitely lesser implication of the posterior and external segments of the hemispheres, though this does not harmonize fully with the accepted experimental localizations. It should be said in this connection that the functional centers delimited in the cerebellum of the dog and monkey are not similarly identified with the lobules of the human cerebellum by different observers. All agree that in the animal

lesions in the crus primum give rise to disorders in the homolateral anterior extremity, lesions in the crus secundum to disorders in the homolateral posterior extremity. More frequently than otherwise, the crus primum is assimilated to the quadrangular lobules, the crus secundum to the semilunar lobules, which is not strictly correct if we adhere to the divisions and comparative scheme established by Bolk. The tentative plan of cortical localization submitted by Mills and Weisenburg would seem to conform more accurately. At any rate Thomas (12) observed a patient with unilateral symptoms limited to the arm and spontaneous deviation of the index outward; an abscess found at autopsy was contained entirely within the lateral segment of the superior semilunar lobule. He concluded that this lobule was a center for the upper extremity and that it presided over the inward or mesial displacement of the extremity. In our case this same region was much less diseased than the mesial segment of the semilunar and quadrangular lobules and the patient evidently gave a spontaneous deviation of the index mesially, and there was prevalence of the adductors of the arm whether in active voluntary movements or in the responses elicited by the Stewart-Holmes test. In other words this observation would tend to substantiate the claim that the superior surface of the cerebellar hemisphere is related to the upper extremity, that the postero-lateral segment is concerned with movements or attitudes of adduction, whereas the mesial segment is concerned more especially with abductor movements or attitudes. A similar correlation cannot be made between the disorders of the lower extremity and the lesions of the inferior surface of the hemisphere, owing to the fact that in the latter situation distinct topographic differences in the severity of the process were much less sharply defined. The most elusive point in this connection however is the anatomic explanation of the anteflexion of the trunk and anteropulsion. The prevailing notion appears to be that the inferior worm and perhaps also the posterior extremity of the superior worm are the parts concerned with the regulation of trunkal attitudes and displacements. Separate centers unquestionably exist for flexion and extension of the trunk as well as for right and left lateroflexion and rotation. The fact that in this case the inferior worm is decidedly less involved than the superior worm naturally tempts one to suggest that the inferior worm presides over movements of anteflexion, the superior worm (posterior segment) over movements of retroflexion or extension. Of course these various considerations on localization are presented in a purely hypothetical fashion, merely as suggestions arising from a

careful and repeated survey of the distribution of the lesions. No claim is made that positive data concerning the important problem of cerebellar localization can be supplied from the study of generalized parenchymatous atrophy of the cerebellar cortex.

It is believed that in isolating and characterizing the phenomenon of anisosthenia Thomas has unravelled one of the most perplexing problems which still confronted us regarding the pathogenesis of cerebellar disturbances. The cerebellum is not a generating station for motor energy, it does not augment the vigor of muscular contraction, but does represent a center or center complex which regulates and coördinates the inherent tonus or sthenic state of the various physiologically related and synergically functioning muscle groups. It ensures the normal reciprocal fluctuations of hypertonus and hypotonus in antagonistic muscles and thus controls the synergy, rapidity and amplitude of movements whether active, passive, automatic or reflex. Each center exerts upon the musculature of a given extremity or segment of an extremity a sthenic influence subservient particularly to displacement of that extremity in a definite direction. As Thomas expresses it, "this function is hypersthenic for certain muscles and hyposthenic for their antagonists; destruction of such a center results in hyposthenia of the muscles controlled by that center and in hypersthenia of their antagonists." It is this rupture of sthenic equilibrium that Thomas has called anisosthenia. In a certain measure this conception is a reversion to the ideas formerly defended by Luciani though with a sensibly different interpretation. Is it not correct therefore to assume that anisosthenia represents the essential clinical manifestation of disordered cerebellar function? Is it not this very loss or perversion of sthenic balance which is responsible for the fact that in cerebellar disease given movements of the extremities are executed with undue rapidity, the limb being raised too suddenly and carried too far, that successive movements are disproportionate and that the various components of a coördinate act are not simultaneously performed? In other words it does seem that dysmetria, adiadochokinesis and asynergy are, in part at least, the result of anisosthenia. The peculiar attitudes of the head, trunk and extremities, as well as the exaltation of static equilibrium (cerebellar catalepsy) can likewise be best explained on the basis of this hypothesis. In fact the majority of cerebellar symptoms can be attributed in large part to impairment or loss of the normal sthenic balance of mutually antagonistic muscle groups.

## CONCLUSIONS

1. Parenchymatous cortical atrophy of the cerebellum is a rare but definite pathologic entity probably largely dependent in the majority of cases upon slowly progressive atresia of the meningeal blood vessels.

2. This lesion, although strictly limited to the cortex, may give rise clinically to all the classical manifestations of disordered cerebellar function such as titubation, oscillations of the trunk, intention tremor of the head and extremities, dysmetria, asynergy, adiadochokinesis, cerebellar catalepsy, spontaneous pointing errors, anisosthenia and disordered speech.

3. The cerebellum probably does not serve to reinforce the dynamic power of the muscular system and is not therefore an organ for the elaboration of motor energy, but does contain centers which preside over and regulate the inherent tonus or sthenic state of the various functionally related muscle-groups. It ensures the synchronous fusion of the various elementary muscular contractions and relaxations of which the coördinate act is the sum total and thus controls the synergy, rapidity and amplitude of movements.

4. The corpora dentata receive cortical radiations from the cerebellar hemispheres and the nuclei tecti radiations from the vermis superior.

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# AN EXPERIMENT ON THE INSTRUCTION OF INSANE SUBJECTS

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1. *Introductory Statement.*—In the training of demented persons for useful activity the first difficulty to be encountered, in many cases, is the unwillingness of the subject to be trained. If this opposition can be overcome, it is a comparatively simple matter to devise tests which will be useful for the purpose of ascertaining what the subject is capable of doing. The preliminary work of gaining the co-operation of an unresponsive subject is to some extent a question of method, and it seems probable that methods which are successful in dealing with demented patients who present unusual difficulties would be of use also in the preliminary training of soldiers suffering from shell-shock or from mental disease of various types. In view of the present interest in education and reëducation of adults who are more or less deranged, it seems worth while to describe in detail a method which I found useful in the training of some very unresponsive demented women.

The method, briefly stated, is to begin by teaching the subject to obey. This is to be accomplished by requesting him to perform some little play task which must be either so attractive that he will comply spontaneously or else so simple that it will not occur to him to refuse. Upon this as a foundation the habit of obedience is to be built up by assigning many other little tasks which vary widely in difficulty and in attractiveness. The daily tasks of a given subject are to become gradually more and more difficult, until he finds himself engaged in some work that is really useful, although not irksome. Simple vocational tests which will be useful for determining his capacity are to be included among the play tasks, and his reactions to different tasks are to be observed with great care as a means of discovering his interest in different activities. As soon as his full coöperation is won he is to be given instruction in the work for which he seems best fitted, with all possible regard to his interests.

2. *Development of the Experiment.*—The primary purpose of

my first experiment in the training of demented was to determine the effects of practice in the repeated performance of a simple act.<sup>1</sup>

In any experiment which calls for serious effort on the part of an insane person, the principal variable with which the experimenter has to reckon is not the ability, but the willingness of the subject. Sometimes a patient will cheerfully consent to serve as subject, but obstinately refuse to conform to the rules of the experiment. In the test known as "Crossing out A's," for example, my subjects were requested to begin at the top of the page and work from left to right, always finishing a given line before proceeding to the next. Some of the subjects followed the instructions with great care, but others invariably worked by random methods, leaving the accuracy of the work mainly to chance and occasionally making errors that appeared to be intentional. Some subjects gave good coöperation at first, but lost their interest in the test as soon as the novelty began to wear off. They apparently regarded it as a game that they might play or not, according to their pleasure.

In an experiment on practice effects the validity of the results depends very largely upon the coöperation of the subject. Positive results can hardly be expected from a subject who fails to take advantage of the practice; and negative results indicate merely failure, not inability, to profit by experience. Partial coöperation is more disturbing to the experiment and more disconcerting to the experimenter than frank refusal to coöperate. One cannot discard the results obtained from unwilling subjects, and yet it is obviously unfair to include them.

In order to reduce the chances of having the results vitiated by the capricious behavior of the subjects, I adopted for the next experiment the following plan: to employ as subjects the most unwilling patients who could be induced to do anything at all, and to give them tasks so simple as to call for the minimum of coöperation. One of two outcomes was to be expected: if the subject's coöperation should improve by reason of general adaptation to the experiment, it would be possible to work up gradually to tasks of greater complexity; but any reduction in coöperation would necessitate the elimination of the subject from the experiment, and the undesirable subjects would be dropped in the early stages rather than in the more advanced stages of the series.

This experiment was commenced in 1911 in the Government Hospital for the Insane, and was continued the following year in the Warren State Hospital, Warren, Pennsylvania. The apparatus

<sup>1</sup> Experiments on Habit Formation in Dementia Præcox, *Psychological Review*, November, 1911.

consisted largely of kindergarten and primary-school materials, and the subjects were selected as being the most troublesome patients who could be used in the experiment without serious danger to the experimenter. Of all the subjects employed for intensive study, the most difficult and unresponsive was a woman whom I had under almost daily observation for a year at the Warren State Hospital. The attempt to train this patient taxed the resources of the instructor to the utmost, and a condensed report of this case will serve as an illustration of the method.

3. *Report of Individual Case, Illustrating Method of Instruction.*—The subject was a woman of thirty-five, a college graduate. The case was diagnosed as dementia præcox, hebephrenic form. At the time of the experiment she was rarely known to speak coherently, but she chattered to herself almost constantly, her favorite expression being "The shape was on the brain." Much of her talk was entirely unintelligible.

During the first weeks of observation it was impossible to gain the attention of the subject. When addressed by name she reacted by talking louder than usual, laughing excitedly and reiterating her stock phrases. But although she took no notice of anything that was said to her, she showed considerable interest in toys. She was disposed to meddle with anything in sight, and her infantile curiosity concerning objects furnished the best avenue of approach. Day after day certain things were laid on the table before her, and at first she was permitted to play with them as she pleased. Later some instruction was attempted, but she would rarely submit to any guidance. She would string beads indiscriminately, but could not be induced to follow a pattern or to take any notice of differences in color and form. She would play with the pieces of a picture puzzle, first arranging them in a row and then making meaningless changes in the order, but she would not try to match the pieces, nor even turn them right side up. When she was shown how to put them together she showed no interest in the picture, but immediately took them apart and played with them as before. When given ten blocks numbered from one to ten, she played with them, but took no notice of the numbers; occasionally she would respond to the suggestion to arrange them in serial order, but she could not be induced to arrange them according to a fixed pattern.

In the fifth week of observation she was given a peg board twelve inches square, and a box of pegs which were of six different colors. This immediately became her favorite toy, and she would play with it by the hour. When she was excited and irritable, a few

minutes' play with the pegs almost invariably tended to quiet her. The act of putting a peg into a hole was apparently the focal point of her interest in this toy. Occasionally she would remove all the pegs from the board and take a fresh start, but usually she busied herself for an indefinite time by taking out one peg and putting another in its place. At first she used pegs of different colors indiscriminately, and showed no interest in the colors; later in the year she not infrequently filled the board almost entirely with pegs of one color, but she was never observed to follow this plan without at least one error. Neither by questions nor by observation was I able to learn which color she preferred. When I occasionally substituted a box of plain pegs for the colored ones, she did not appear to know the difference. There was no evidence of defective color vision, but it was plain that her interests were motor rather than sensory.

The peg board was of inestimable value for the purpose of gaining the good-will of the subject, but it was useless for purposes of instruction. In order to teach her to obey, it was necessary to use something which permitted less freedom of action. The first test in which she regularly gave voluntary coöperation was a practice series with a form board having ten holes of different forms, each fitted with its own block. Accustomed as she was to the peg board, in which any peg can be used in any hole, she tried at first to force the blocks of the form board into the wrong holes. But as this was impossible, she soon learned to place them correctly. She could refuse to play with the toy at all, but if she did anything with it she must almost of necessity do the right thing. At each trial she was requested to fit the blocks into their holes as quickly as possible. As she was naturally disposed to be rapid in all her movements, tests of speed were quite in line with her tastes. The time of each trial was measured by a stop watch, and the first series of one hundred trials showed unmistakable improvement as the result of practice.

The next toy presented was a device that might be called a color board, a board with ten round holes of equal size, the spaces around the holes and the discs which fitted into them being covered with colored paper of ten different colors. The subject was requested to put each disc into the hole of the same color, as quickly as she could. It was entirely possible, of course, to put any disc into any hole; but the suggestion to match the colors was very strong, and she usually obeyed it. The time records of the first series of tests showed no improvement, not so much because of failure to coöper-

ate as because of failure to adopt any particular method of handling the discs. Later she became more amenable to instruction, and it was possible to teach her to use a definite method. In the second series of tests the effect of practice was very marked.

The most difficult formal task which this subject mastered was the arrangement of sixteen blocks according to an arbitrary pattern. With great difficulty, and with the aid of two intermediate steps which need not be described here, she was taught to use both hands coördinately.

When picture puzzles were again presented, she gave very good coöperation. The first puzzle offered was a very simple one made by cutting a postcard into eight square pieces. She made very hard work of the task, and it was necessary to show her in detail how to match the pieces, but after much practice with puzzles of increasing difficulty she was able to solve without assistance a puzzle of twenty pieces. She showed increasing interest in them, and her talk contained frequent references to the picture or to the process of solution. Once she said to herself "I guess I've lost the connection here," which was almost the only intelligent remark I ever heard from her. A more characteristic comment was given after she had finally succeeded in assembling the picture of a bird: "The form was on the brain; this bird was proved to be complete on the brain."

At this stage of the experiment the subject followed to the best of her ability every suggestion that was offered. Frequently she worked long and faithfully on a task that was entirely too difficult for her. She did not learn, however, to keep her hands still nor to give much attention to verbal instructions.

Because of her inability to wait for instructions, the first lessons in a raffia basketry presented great difficulty. She was told to "first wind the raffia around the reed, then sew through the next hole." But she would sew through the same hole repeatedly, without stopping to wind the reed. When this step of the process was finally forced on her notice, she would wind repeatedly and neglect to sew at all. In order to teach her to do two things alternately, I gave her some beads of two colors, with instructions to string first a yellow one and then a green one. At first I handed each bead to her, and later allowed her to take a bead from the box, while I kept saying: "This time a yellow one; now a green one." This was kept up daily until the habit of taking the two colors alternately was so well established that she did it spontaneously. Then the raffia work was resumed, and the instructions were given repeatedly: "This time wind it around the reed; now sew through the hole." In course of

time she mastered the stitch so that she was able to work independently to the end of the needleful, but she did not learn to thread the needle. With considerable assistance, she made one raffia basket and several small reed baskets.

During the entire year, however, she continued to find her greatest pleasure in the peg board, and she was usually permitted to have a period of free play with it at the close of her formal lesson. She was so quiet, when thus occupied, that her presence was not a source of disturbance to the experimental work with other subjects.

So far as I know, nothing of permanent importance was accomplished for this patient, and I doubt her capacity for learning to perform unaided any tasks except the most mechanical. The following notes, taken almost at random from my note book, may be of interest as indicating the degree of dementia: "The peg board was on the farther side of the table; she reached over and played with it at arms' length, and did not move it. After waiting half an hour to see if she would draw it to the front of the table, I finally did it for her." "She was found running a broom up and down the corridor, exactly as if it were a floor polisher." "In her basketry work she accidentally displaced a peg; paused and set it up, then went on with the weaving. There is no evidence that the unit act in basket weaving has any more meaning for her than the setting up of a peg."

This case is not considered worthy of being reported, except as a means of describing the method used for gaining the coöperation of a difficult subject.

4. *General Observations.*—It has not been possible for me to carry the intensive work so far with any other subject, but I have followed the same general plan in the instruction of six other women who were in so advanced a state of dementia that one could hardly expect the training to be of lasting value to them. All were troublesome patients, and offered more or less resistance to instruction; but in each case the opposition was overcome, and the subjects gave voluntary coöperation in a prolonged series of tests.

Some of my mistakes were so instructive that it seems worth while to call attention to them. In my work with one patient (Subject 12, Government Hospital), I spent the first twelve interviews trying to gain her coöperation in two formal tasks, the simplest ones that I had to offer. The patient was extremely demented, and it was almost impossible to gain her attention. It was with the greatest difficulty that I was able to induce her to set up twenty pegs, and I failed to obtain a single record in the other task, the

arrangement of ten blocks. At the thirteenth interview I offered an eight-piece picture puzzle. She responded immediately, and worked for twelve minutes with concentration that was surprising in a person of her mental condition. She did not succeed without assistance in solving this puzzle or any other picture puzzle that was subsequently offered, but she never of her own accord abandoned the attempt. From the moment when the puzzle was first presented, she gave perfect coöperation in everything that she was requested to do. After showing her how to solve the puzzle, I gave her another trial with the arrangement of blocks, the task she had so persistently refused to perform. She complied eagerly at this time and at subsequent interviews, and in four consecutive tests her time records in seconds were 151, 81, 58, 53. This is the most perfect practice curve I have ever obtained from any subject.

The next case selected for intensive study was the Warren State Hospital case reported above. This time it was the picture puzzle that I tried to force on the notice of the subject, but it was by means of the peg board that her coöperation was won. My mistake was in presupposing the interests of the subjects. I used a motor test for a subject whose interests were visual, and then used a visual test for one whose motor interests were preponderant. Had I given more time, during the first few interviews, to a rapid trial of all materials at hand, I might have saved time in my work with these subjects, and might quite possibly have found a way to interest some of the patients whom I failed to reach.

Another easily avoidable mistake was made in the earlier experiment. The tests were regularly presented in the same order at each interview, and some of the subjects grew to regard this programme as a routine procedure. One of the subjects referred to above as giving partial coöperation was greatly disturbed by any deviation from the usual order. I was not successful in gaining her coöperation for new tasks, nor for old ones presented in a new way. If during the first week of observation I had varied the programme from day to day, so that she would not have learned to expect strict uniformity, it is possible that she would have been more responsive in the latter part of the series. The easiest method of gaining a subject's coöperation in the early tests is not necessarily the method that will be most successful for a prolonged course of instruction.

In the development and application of the Kent-Rosanoff association test I had occasion to request the coöperation of nearly one thousand normal persons of limited education, and more than five hundred insane patients. Even among normal persons I found

many who were unwilling to submit to the requirements of the test, although I explained with great care that no use was to be made of the data except for statistical purposes. The number of insane patients who refused to coöperate was very considerable, and I encountered many others who all but refused, but no patient was dismissed until I had exhausted my resources for gaining his coöperation. If a patient responded well for a time and then refused to continue, no effort was spared to obtain a complete record, although it frequently required several hours. I was at a serious disadvantage, both because the experiment called for a verbal reaction from the subject, and also because I had nothing to offer except the one task. I have found it much easier, in general, to obtain a motor reaction than a verbal response; and it is usually easier to induce an unwilling subject to do one of several things than to do one thing in particular.

5. *General Application of Method.*—My experience in dealing with unresponsive subjects has led me to formulate, primarily for my own use, a definite plan for overcoming the opposition of a negativistic patient.

A preliminary series of tests is to be performed upon any subject who is disposed to offer resistance to educational measures, in order to gain his full coöperation before beginning regular instruction. The preliminary work is not to be standardized, nor to be applied uniformly to all subjects, but is to be adapted to the individual.

In order to cultivate the habit of obedience, various tasks are to be assigned at each interview, every task being well within the limits of the subject's ability and power of attention. The tasks are to vary widely in kind, and there should be an abundance of each of the following types: mechanical and mental; simple and complex; easy and difficult; known and unknown; obviously useful and apparently useless; interesting and tedious; pleasant and unpleasant.

If the subject can be induced to do in response to suggestion one thing which he would rather not do, and if the instructor can thereafter avoid irritating him, the chances for gaining his full coöperation are good. But if after having gained a subject's partial coöperation the instructor should accidentally offend him, the chances for regaining what has been lost are very poor.

The first task of the instructor is to find out what tasks are most interesting and attractive to a given subject. At first it will be necessary to work by the "trial and error" method to find something



that the subject can be induced to do, but the first response will indicate what kind of task should be offered next. By observation of the subject's reaction to each task, the instructor should note his likes and dislikes, and should take care to offer something pleasant. After a beginning has been made toward producing the habit of obedience, everything should be done to strengthen it. The interview should be omitted if the subject is known to be in an unusually difficult mood, and great caution should be exercised to prevent a single lapse. It is of special importance that the last task offered at a given interview should be performed willingly; if some task is known to be irresistibly attractive to a subject, this may be held in reserve to be offered just before dismissal some time when he has been unresponsive.

The greater the effort to induce a subject to perform a certain task, the more harm will result from his refusal. For this reason, it is better to give the suggestion in the form of a request than in the form of a command. In case of non-compliance, it is well to pass the matter over as lightly as possible, so that it will not be too vividly remembered at the next interview. On no account should the instructor manifest any annoyance, and rarely any disappointment. If there is no favorite task which can safely be offered, the interview should be closed as pleasantly as possible: "Never mind, that is all for today; perhaps you will feel like doing it for me tomorrow." At the next interview, however, it is well to begin with something more attractive.

The subjects to be trained will represent all degrees of mentality. They will vary widely in general intelligence, education, and tastes. Some will be fairly bursting with energy that needs only to be directed, and some will be so inactive that it will require patient effort to induce them to make a single movement. Some will expect to be treated with formal courtesy, others may more appropriately be approached as if they were school children.

At the first interview with a new subject the instructor should assume the best, while being prepared for the worst. It can do no harm to treat a subject with more consideration than he is capable of appreciating, while it may do irreparable harm to presuppose less intelligence than he actually possesses. It is safe to assume, until one has personal knowledge to the contrary, that the subject will of course comply with any courteous request, as a matter of courtesy. And on this assumption it is well to offer a task that the subject can perform in almost less time than it would take him to refuse or to demand an explanation; it is possible that he will comply before he knows it.

Occasionally a subject will be found who manifests a strong desire to comply with the instructor's wishes, but who lacks the initiative. A timid or lethargic subject may sometimes be won by a little coaxing and encouragement. But in general urging is to be avoided, except when the instructor is very confident that it will be successful.

As long as the suitable tasks hold out it is well to offer a new one each day, and to avoid an exact repetition of those of the preceding day. Neither the tasks nor the order of their presentation should be so uniform from day to day as to lead the subject to regard a certain routine procedure as an essential part of the programme. On the other hand, there should be from the first enough repetition so that he will not assume that he is to have a new set of toys each day. Great care must be taken to avoid establishing any undesirable precedent. Obedience to any request is to be cultivated, not merely the willingness to perform a given task.

As the instructor becomes familiar with the tastes of a subject, it will be well to compile a list of the tasks arranged in the order of his apparent preference. Gradually, as the subject becomes more responsive, it should be the definite aim of the instructor, at each interview, to assign the most difficult and unpleasant tasks that will be performed well and willingly. Tests of speed are to be preferred for subjects who are slow and accurate in their movements, and tests of accuracy for those who are habitually rapid and careless. At this period it may be possible to bring out, for a second trial, the tasks which the subject has most obstinately refused to perform. This, of course, should be done very cautiously.

When the subject's opposition has spent its strength and after the habit of prompt obedience is fairly well established, he may be given certain useful tasks which he can perform alone or under the supervision of an attendant. These tasks should at first be of such nature that the instructor can inspect the results. Any work well done should be praised freely, but work poorly done should be criticized very delicately, if at all.

The last of the experimental tasks should be made as irksome as the subject's attitude will permit, and the first useful work should be made as attractive as conditions permit. Thus the transition from play to work will be gradual, and some subjects may be so tired of the tests that they will welcome the change to real work. In other cases it may seem advisable to continue the laboratory experiments until the subject's interest in his work is well developed.

It is to be expected that a subject of fair intelligence will recog-

nize the significance of the experiments as a means of determining his ability for certain kinds of work, and it will do no harm to allow him to exaggerate their importance as vocational tests. The fact that their primary purpose is to gain his coöperation should be concealed from him, if possible, but verbal deception is to be scrupulously avoided. A half-truth is much safer than a lie, and usually quite as serviceable. The subject's inquiries as to the purpose of the laboratory work should be answered very simply, if they cannot be ignored. The instructor may reply, "I wish to see how quickly (or how accurately) you can do this," on the assumption that the inquirer refers to the task just offered. If a subject of unusual intelligence presses the question as to the purpose of the entire experiment, the instructor may be able to silence him by showing a few graphic representations and explaining the scientific purport of the study. Frequently a subject's interest may be stimulated by showing him one of his own records that is exceptionally satisfactory, but he should not be permitted to see a poor record.

If the subject's interest can be held and developed, there is little danger that his questions will be seriously embarrassing to the instructor.

6. *Tasks and Materials.*—The method does not require elaborate or costly apparatus, and one can carry in a handbag all the materials that are strictly necessary. Tasks which can be improvised without special apparatus possess certain advantages over formal laboratory tasks. Some subjects who might at first resist being experimented upon will comply readily if requested to move a chair, close a door, address an envelope, or to perform any other trifling personal service that suggests itself to the instructor.

Any vocational tests that are available should have an important place in the work with an advanced subject, and difficult mechanical puzzles can be used to good advantage. It is important to have an abundance of tasks that can be offered to an intelligent man without insulting him, but it is necessary also to have simple tasks for beginners. Kindergarten toys and Montessori materials may be useful with some subjects, also the Binet, Goddard, Healy and Franz tests. The stop watch is useful as a means of making a simple task more dignified. The request "Let me see how quickly you can put ten pegs into the front row of holes" may transform the most babyish of activities into a test of motor coördination. The watch may be handed to the subject, with the request that he start it and stop it at exactly five seconds; a subject who shows interest may be given several trials, and the results may be recorded

as a rough test of his reaction time. The counting of money is a useful task, readily adaptable to the intelligence of the subject. An excellent task for advanced subjects is to assist in making picture puzzles and other cardboard apparatus for use in the laboratory.

Of all the tasks I have used, the practice test is the most generally serviceable. Five trials with the form board are almost sure to give a record that will bear inspection, and the curve may be plotted in the presence of the subject; this will serve as an introduction to a more elaborate practice test, and the plotting of the curve at different stages will furnish several more tasks. A practice series may be based upon almost any test or puzzle, and will afford a convenient excuse for offering the same task many times. As almost any experimental task tends to become tiresome by reason of frequent repetition, the practice test furnishes automatically the increasing irksomeness which is an essential feature of the method.

The instructor must be able to handle the materials rapidly, so that the subject's patience will not be exhausted by long waiting. In general, the most useful instruments are those which can be most readily adapted to different uses.

## Critical Digest and Review

### WAR NEUROSES AND PSYCHONEUROSES

BY DR. SMITH ELY JELLIFFE AND DR. CHARLES ROCKWELL PAYNE

(Continued from page 253)

#### CHAPTER I. *Definition and Etiology*

MacCurdy has well-defined war neuroses as those functional nervous conditions arising in soldiers, which are immediately determined by the conditions of modern warfare, and have a symptomatology whose content is directly related to war.<sup>1</sup> The term "shell shock" has been officially adopted by the British War Office as the diagnostic term to cover all neuroses arising among officers and soldiers of the armies. This term is picturesque and appeals to the popular imagination but it can scarcely be defended from a medical standpoint. In the first place, it implies a single etiology—the physical effects of high explosive shells on those subjected to bombardment, who suffer no external physical injury—which is far from being even the main factor in the determination of the symptoms. Secondly, the clinical types covered by this blanket diagnostic term are too various to be safely included under one heading. A further objection to this designation is that it tends to give the soldier a wrong idea of the source of his trouble, to mask the mental etiology of most of his symptoms. It is therefore more advisable to use the term "war neuroses" which gives the desired latitude in grouping together the different clinical pictures that occur and focuses the attention on those influences which come directly from warfare.

Eder voices the opinion of most of the observers in this field when he says that the war has created no new psychoneuroses.<sup>2</sup> "We have learned much that is new about the old diseases and obtained new evidence confirming earlier views. We have learned

<sup>1</sup> War Neuroses. John T. MacCurdy, Lieut. M. R. C., U. S. A. *Psychiatric Bulletin*, July, 1917.

<sup>2</sup> War-Shock. M. D. Eder, Late Temp. Capt. R. A. M. C. P. Blakiston's Son & Co., Philadelphia, 1917.

that a psychoneurosis can be produced by stress of external conditions acting on a nervous system which is but a degree or so more sensitive than the average person's—a sensitiveness which should have involved no disability in life under average conditions, rather the contrary—it might tend to success in a man's particular vocation, or make an artisan take a lead in the affairs of his own trade, or parish affairs, or enter Parliament."

Though the form of these war neuroses is the same as that of the peace neuroses, there is a difference in kind; in the war neuroses, the external psychic factor Eder thinks, is overwhelmingly greater than the second factor, the predisposition. Eder agrees with Grasset<sup>3</sup> that it is the presence and predominance of the psychic element upon which emphasis should be laid in these affections.

In much the same view, Lépine,<sup>4</sup> who has given us one of the best of the shorter collections on mental troubles of the war writes—the nervous and mental troubles of war are no novelty. The colonial expeditions have offered excellent examples. The South African campaign, the Russo-Japanese war gave rise to the first collected studies of this character. Russian psychiatrists especially have published many interesting and valuable observations, Soukhanoff, Vladitchko, Ermakoff, Autokratoff, among others, in France, the abrupt character of the opening of the war, placed a very heavy drain upon its leading neurologists and psychiatrists, for one of the most difficult phases they had to meet was the lack of training in neuropsychiatry of the average medical officer. All grades of false prejudices, on the part of the line officers had to be overcome. Universal misconceptions relative to these problems had to be met. The commonest error, all too prevalent here in the United States as well—that had to be grappled with was that all mankind was conceived of as divided with two classes—sane or insane, normal or abnormal. This totally false intellectualistic preconception, held to by both the medical and lay mind had to be combated. Thus, writes Lépine, in the early days of the war, soldiers arrived in his service, covered with mud, dust of the field of battle in evident state of commotional stupor. They were labeled from the front—insane, psychotic, dingo, simulators, or malingerers, and a host of other titles. While this general phase has passed and some order has been obtained from the confusion by the efforts of the French neuro-psychiatrists, there still remains too much of the tendency to overlook the dynamic as-

<sup>3</sup> Lépine, Jean. *Troubles mentaux de guerre*. Masson et Cie, Paris, 1917.

<sup>4</sup> "Les psychonevroses de guerre," *Presse Medicale*, April, 1915, p. 105. *Tr. Med. Press. Circular*, London, June 9 and 6, 1915; also to be found in *Bost. Med. and Surg. Jl.* in part, 1918.

pects and to rely upon clear cut definitions which are purely verbal and mean little when the actual individuals are studied.

While certain authors—notably George Dumas—have attempted to maintain that the war has created separate disease entities, Lepine expresses himself definitely to the contrary. At the risk, he says of seeming to have been quite ignorant of conditions at the outbreak of the war, he has found his neuropsychiatric notions undergo considerable modification as his actual experience has increased. Assuredly only those symptoms which have already been described come under observation. We live, he says, in the midst of mental forms which are perfectly familiar to us, but that which does differ, from time of peace is their origin and their evolution. Never before have so many examples of all sorts of intermediary forms been under observation. The immense zone of variation and the uncertainty of limitations within which cerebral function may show disordered modification—this to Lepine as well as to many another, has been the most fruitful gain in the present war experiences.

MacCurdy divides the war neuroses into anxiety states and conversion hysterias. The anxiety states, in which morbid fear and dread dominate the clinical picture, occur very much more frequently among officers than among privates. The greater responsibility of the former is probably a large factor in determining this ratio. The conversion hysterias, so-called because an idea is transferred over into a physical symptom, are the most frequent neuroses met with among privates and non-commissioned officers. The symptomatology of both these conditions will be considered later.

An interesting point to note in passing is the very greatly increased frequency of occurrence of war neuroses in modern warfare. MacCurdy interviewed British medical officers who served both in the Boer War and in the present conflict. They were unanimous in stating that no such percentage of neuroses occurred in the casualties of the former war. "It is impossible to consider that the human race can have deteriorated appreciably in the matter of fifteen years," says MacCurdy, "and therefore we are safe in assuming that it is modern warfare which has produced these conditions." Trench warfare and the appalling artillery fire are probably two important factors in this connection.

"In previous wars, the soldiers were called upon to suffer fatigue and expose themselves to great danger. In return, however, they were compensated by the excitement of more active operations, the more frequent possibility of gaining some satisfaction in active hand

to hand fighting, where they might feel the joy of personal prowess. Now, the soldier must remain for days, weeks, even months, in a narrow trench or stuffy dug-out, exposed to a constant danger of the most fearful kind: namely, bombardment with high explosive shells, which come from some unseen source, and against which no personal agility or wit is of any avail. This naturally occasions great fatigue, and on the other hand, opportunities of active hand to hand fighting are rare, so that a man may be exposed for months to the appalling effects of bombardment and never once have a chance to retaliate in a personal way. Consequently the sublimations are more difficult to maintain than in any previous war. The soldier becomes fatigued and not unnaturally finds it difficult to remain satisfied with his situation. His adaptation to warfare is, therefore, soon weakened or lost. His disregard of the carnage and death around him is gone, and he becomes every day more acutely sensitive to the horrors which surround him. This sensitiveness may develop even to the point of pity for the foe, which is naturally an emotion most incapacitating for a soldier."

"The bonds uniting him to the common cause become definitely loosened and his individual feelings begin to assert themselves. Accidents to which he was previously liable, but to which he was indifferent, are now viewed with apprehension. He becomes fearful of the dangers opposing him, so that his courage is no longer automatic but forced. According as he has high or low ideals, is more or less intelligent, he feels a shame before his fellows as a coward, or feels illtreated by his superiors in being forced to continue fighting. His feeling of cowardice may lead to superhuman efforts of selfcontrol, but these lead only to cumulative increase of his fatigue. Naturally he grows mentally and nervously more and more unstable, but is prevented from leaving the line, either by his superior officers or by his own shame at the thought of 'going sick' which is frequently looked upon as a sign of weakness. Those of lesser intelligence often regard their terrors as indications of approaching insanity, and thus another worry is added to the strains under which they suffer. Once a man has acquired this unhappy condition, any trifling accident, such as a mild concussion from an exploding shell, or some particularly unpleasant experience, may cause a final break and lead to such an exaggeration of symptoms already present that he becomes totally incompetent.

"It is not unnatural that anyone in this situation should look for some relief, and, unconsciously at least, this must be a powerful factor in the production of disabling symptoms. In many cases,



after more or less of these prodromal difficulties, symptoms appear that seem to be specifically directed against the man's capacity to fight.

"As many physicians in England, previously apathetic or antagonistic to psychoanalysis, now admit, the general mechanism of repression of emotionally toned ideas with their reappearance when repression fails, are responsible for the production of the symptoms of the war neuroses. Psychoanalysts in civilian practice claim that the individualistic tendencies in question are preponderantly related to the sex instinct. In war, however, this does not seem to be the case, these latter tendencies coming into play, apparently, only as a complication. The reason for this is probably to be found in the fact that in warfare the instincts of self-interest and self-preservation, which are equally as primitive and basic as the sex instinct, are involved in a way that they never are in civilian life. The psychological factors are consequently much more simple and it may be that this explains the extraordinary amenability of the war neuroses to treatment. Personality studies of many of the cases, however, show a previous weakness in adaptability that is confined to such demands as are essentially related to sex. These individuals, although they may never manifest symptoms directly related to any erotic tendencies, are nevertheless apt to suffer sooner or more severely than their completely normal fellows. The explanation of these two phenomena is perhaps to be found in the fact that sex adaptation is quite the most difficult of all those which the individual has to make in modern civilization. The same fundamental weakness exhibits itself in his failure to respond fully to the most trying demands of civilian life, namely, those of sex adaptation, and in his inability to meet the demands of war. In other words, the neurotic in times of peace may have his symptoms on account of poor adaptation in the sex sphere, but this is fundamentally dependent on some vague constitutional defect from which he suffers. It is this defect which also makes him liable to lose his efficiency in the unparalleled strain of modern warfare. One makes inquiry into a patient's past life, therefore, not only in order to discover what there may have been in his previous character which would directly affect his capacity as a soldier, but also to gain some rough idea of how resistant he had previously been to the most disturbing influences of life."<sup>5</sup>

Ernest Jones<sup>6</sup> in discussing the War Neuroses and Freud's

<sup>5</sup> MacCurdy, War Neuroses.

<sup>6</sup> Ernest Jones, War Shock and Freud's Theory of the Neuroses. Abstracted in *The Lancet*, April 20, 1918.

Theory of the Neuroses says in substance: Freud's theory is expounded in five statements, of which most observers of the psychology of war neuroses have largely confirmed the first three. These are: (1) That psychoneuroses are of volitional origin, that they are produced by a purposive will, though not, it is true, by the whole of the patient's conscious and deliberate intention. (2) They are the result of an intrapsychical conflict between what may be called "ego-ideals" and tendencies alien to and disapproved of by these. In the case of war neuroses there is perhaps always a conflict between the instinct of selfpreservation and the desire to escape from the horrors of warfare on the one hand, and the motives leading to continuance at duty, with shame at fear, on the other. (3) The volitional impulse or wish leading to the production of the neurosis is "repressed" and unconscious. In the case of the wishes just mentioned this is partly the case—that is, the desire to escape to safety at the expense of other considerations is "repressed" by the ego-ideal and is only half-conscious, sometimes hardly so at all.

The principles that have not been investigated, and therefore not yet confirmed, are (4) that no current conflict or repressed wish can lead to a neurosis unless it becomes associated with and reinforces an older repressed wish belonging to an infantile conflict that has never been resolved. It is pointed out that there are many ways in which this association can become established because of the extensive series of re-adaptations that the ego-ideal has to make on being brought into immediate contact with the facts of war (cruelty, etc.) (5) That the earlier repressed wish is of a sexual nature. Where the war shock is the predominant factor in evoking the neurosis it is to be expected that earlier ones are of less importance and less in evidence unless sought for. In the special case, however, of war dread (technically "anxiety") the suggestion is made that just as this symptom in peace neuroses is invariably a discharge of repressed "sexual hunger," so in the dread of real danger it emanates from the narcissistic component of this instinct (self-love) which is attached to the ego. Dread is thus always a morbid phenomenon, and is to be distinguished from the useful defensive reactions (preparedness, with flight or fight) of the biological fear instinct.

Harry Campbell<sup>7</sup> says that it is chiefly among the unstable nervous systems that the neuroses are met with in war.

Eder,<sup>8</sup> on the other hand, disagrees with this statement and quotes Elliot Smith<sup>9</sup> as saying: "It would be a gross misrepresenta-

<sup>7</sup> *The Practitioner*, May, 1916.

<sup>8</sup> Eder, *War Shock*, p. 14.

<sup>9</sup> Elliot Smith, "Shock and the Soldier," *The Lancet*, April 15 and 22, 1916, p. 855.

tion of the facts of the case to label all the soldiers who suffer from mental troubles as weaklings. The strongest man when exposed to sufficiently intense and frequent stimuli may become subject to mental derangement. It is quite common to find among the patients suffering from shock senior non-commissioned officers who have been in the army fifteen or twenty years . . . and have stood this severe strain. Such men can hardly be called weaklings."

Nonne<sup>10</sup> admits that the hysterical syndrome is more easily aroused by adventitious factors than was thought. Mann<sup>11</sup> agrees that the healthy can become momentarily hysteric, and Hoche<sup>12</sup> contends that every combatant can become hysterical under appropriate experiences.

Grasset<sup>13</sup> is of the same opinion. "The personal antecedents, antebellum and hereditary, have relatively little importance in the development of the psychoneuroses of war. My conclusion would be different if I had to deal with the war psychoses."

Eder further emphasizes the fact that the present British army, and this applies with equal force to the American, is composed largely of men drawn suddenly from civilian life, who have had little time to adapt to the strain and routine of military life. In normal civilian life, they would probably have been equal to any emergency. But for some—among the very best—the new conditions called out to them to strain themselves to the very utmost, and this was just a little too much.

It has been the common observation of the army medical men that the war neuroses rarely occur among soldiers severely wounded. This phenomenon is not hard to understand from the psychological viewpoint. In these patients, the psychical energy is sufficiently occupied with something very concrete and real; there is none to spare for the creation of phantasies and the conversion of these phantasies into hysterical symptoms. And further, the wound has furnished the individual a release from his unbearable situation, relieved the tension and afforded him some sort of a solution for his mental conflicts.

Eder's admirable summary is worth quoting in full, although, we hope to present other aspects of this problem of etiology which tend to show that he deals too exclusively with base hospital situations. For with accumulating experience, as Lépine has confessed and as Leri<sup>14</sup> emphasizes it is absolutely imperative to have studied the

<sup>10</sup> Archiv f. Psych. u. Nerv., 56, Heft 1, 1915.

<sup>11</sup> Deutsch. med. Wochenschrift, No. 4, 1915.

<sup>12</sup> Archiv f. Psych. u. Nervenheil., 56, Heft 1, 1915.

<sup>13</sup> Presse Medicale, April, 1915, p. 107.

<sup>14</sup> Leri, A. Commotions et Emotions de Guerre. Masson et Cie, 1918.

cases (1) in the front line trenches, (2) at the casualty and ambulance stations, and (3) at the base hospitals, since the pictures undergo kaleidoscopic modifications, and descriptions and observations drawn from base hospitals alone, as they for the most part have been, present a screening of certain types only and give a totally false picture of the situation as a whole. This point must be dwelt upon since much of the literature has come from the physicians in the base hospitals, where they have seen certain groups of cases only. The regimental surgeon at the front has little time to record his observations—no opportunity to see what happens to the various cases, and the man back of the line can usually get very little straight information of the numerous environmental factors, which are usually known only by the company officers, corporals or sergeants. This is one of the reasons why there are many discordant views. Various observers are observing a disease picture at different periods of the evolution and are apt to give a cross section view of it. Long section studies are only just beginning to appear.

"War Neurosis," says Eder, to return now to this author, "is hysteria occurring in a person free from hereditary or personal psychoneurotic antecedents, but with a mind more responsive to psychical stimulus than the normal. The wrenching from the customary calling and life, the new discipline, the peculiar and terrible mental strain of modern war conditions acting upon this sensitive mind determine the disease among soldiers. Shell shock, gas poisoning, or other physical injuries do not cause the disease. The symptoms (which we shall consider later) are protean—palsies, analgesia, amblyopia, mutism, deafness, affection of the vegetative system such as soldier's heart, vomiting, diarrhea, insomnia, loss of memory, somnambulism, phobias and obsessions of all kinds."<sup>15</sup>

<sup>15</sup> Eder, *War Shock*, p. 144.

*(To be continued)*

## Translations

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### ON THE EVOLUTION OF THE NEUROGLIA AND SPECIALLY THEIR RELATIONS TO THE VASCULAR APPARATUS<sup>1</sup>

BY NICOLAS ACHUCARRO

MADRID

TRANSLATED BY DUDLEY FAY

In order to obtain a general view of the results of these researches on the evolution of neuroglia elements, Achucarro states it is necessary to consider the following points:

1. The neuroglia having the appearance of vascular tubes; the vascular tubes "de passage"; the terminal tubes.
2. The ependymal and the autonomous neuroglia.
3. The satellite neuroglia; and the non-neurologic elements or third element.
4. The protoplasmic neuroglia.

1. *Vascular Tubes. Neuroglia.*—It is above all the evolution of the vascular "pied" which Achucarro, believes to be the chief organ of the nutritive or endocrine functions subserved by this type of neuroglia which constitute the principal objects of the author's researches.

From the descriptions one sees that in the teleosts examined the vascular tubes do not exist any longer although in the cerebellum of *Cyprinus* the neuroglia surrounds the vessels although the vascular plexus is very abundant. The ependymal neuroglia traverses the depth of the tissues and becomes fixed at the pial surface. This system is the only one existing in the striated body, but the optic lobes possess a greater structural complication due to the formation of an ependymal system and a more external perforating system. The development of the ependymal system is so enormous, the cells are so abundant in protoplasm that even here one will be tempted to admit the existence of true ependymal glands; for one cannot

<sup>1</sup> Trabajos del Laboratorio de Investigaciones Biologicas de la Universidad de Madrid, 13, 1918.

suppose that this enormous system is necessary purely as a sustaining organ for the optic roof. In any case it is entirely separated from the perforating system and only in contact with the latter externally.

The implantations on the pia mater are colored perfectly by the gold method and very well also by the silver tannate method. The gold method, which sometimes in the human cortex seems insufficient to show the marginal neuroglia, gives excellent results here. The terminations or pial tubes certainly are organs absolutely homologous to the vascular tubes. There often takes place a sort of unraveling of the pial terminations when they come near the surface. It is not easy to give the explanation of this phenomenon, but it is all the more interesting in that in the animal series the vascular terminations act similarly in splitting in the vicinity of the vessels.

If it be admitted that the pial connecting tissue exercises a toxic effect on the vascular terminations and that on account of this action the protoplasm of the vascular cells grows towards the periphery, it is very probable that when this action takes place at a distance, it does so exclusively on the nearest part of the pia mater, while by approaching the source of the tropic influences the lateral parts can also exercise an effect on the growth of the protoplasm thus provoking the division of branches. This method of unraveling is not constant; it presupposes the simplest conditions of the gliotectogenesis, which is disturbed by many causes, as the author has shown in another work on the subject of the gliotectonic of Ammon's horn. Sometimes when the pial surface instead of presenting its usual condition, is narrower because of the ependymal development, one can find converging terminations. Here the fusion of several neuroglia branches in extremely strong and tortuous terminations is seen. A similar structure has been shown by Rio Hortega in the neuroglia of the invertebrates (*Lumbricus*).

The vascular terminations of the neuroglia are of the same kind as the pial tubes. Nevertheless they do not supersede the latter in a decided manner. One of the most interesting facts of Achucarro's researches is the verification of the migratory terminations in the frog. While the gliotectonic does not change its organization and even keeps its connections with the pia mater, in the frog little spindle-shaped or rounded enlargements of the vessels appear, which are nothing but the beginning of the vascular tubes, which are already extraordinarily developed in the lizard.

The vascular terminations therefore appear earlier than the autonomous neuroglia. They coexist in the frog with the epithelial

neuroglia. Without being able to state it absolutely, it seems to Achucarro that the vascular terminations appear first in the regions bordering on the pial surface and later separate from the ependymal surface. It may be that the capacity for growth of the epithelial cells is just sufficient to reach the surface when the development in thickness of the nervous system passes a certain limit. Then perhaps nutritive needs cause the epithelial cells to insert themselves into the juxtapial vessels.

If it be admitted that the existence first in the pial mesoderm and later in the vascular mesoderm of some element which exerts an attraction for the neuroglia protoplasm, it can be supposed also that the element penetrates into the nervous system, slowly starting from the pia mater. According to Held there exists on the vessels in the nervous system a connecting membrane, called the accessory membrane, derived probably from what is called the intima pia in the pia mater. On the other hand the constitution of the capillary walls in the nerve tissue is not absolutely known and although according to Robertson and Cerletti it is proved that there is always an adventitious membrane on the first capillaries. A deeper study of the constitution of the vascular walls in the nervous system by recent methods on representatives of the various groups of vertebrates is necessary to establish in connection with the implantation of the neuroglia elements, whether there is an anatomical cause to explain the glial tropism.

The study of the neuroglia system of the lizard has shown that in reptiles the vascular terminations are enormously developed although here also the gliatectonic is principally epithelial and radiated. It must be remembered nevertheless that from this last point of view the lizard represents an intermediate step, for the development of the epithelial neuroglia towards the autonomous phase has already commenced in this species. The colorations in the nervous system of the lizard are clearer than in the frog and can also be compared with the different organs of the brain according to the importance and the abundance of the vascular implantations. In the nucleus of the septum and in the thalamus the connections with the vessels are most important and numerous. The difference from the other parts of the brain and above all from the cerebral cortex and the optic roof is very great, so that it seems as if the thalamus and certain median nuclei are the places where the evolution commences. This fact offers an interesting problem to pursue, namely the chronological topography of the implantation of the neuroglia on the vessels, a study which could perhaps give some information on the functions of the neuroglia.

In the lizard as in the frog migratory tubes are found: Yet the majority are extraordinarily developed and do not pass beyond the vessel to which they are already attached. Thus they are already terminal tubes just like those which are seen in mammals.

It is interesting to note that in the lizard and the frog the complicated whirling and other forms that Cajal has described in the cat and the rabbit are not found. The tubes are conical, thinning over the vessels and similar in every way to those known in man and the monkey.

In birds examined by Achucarro the vascular connections are very narrow and can be found everywhere in the primordial ganglion, but here still other notable variations are found. As is well known the neuroglia is totally autonomous. The neuroglia cells are seen attached in large measure to the surface of the vessels, forming crowns in transverse section. Besides the vascular insertions are very much extended so that real coverings of neuroglia surround the vessels, a situation which one finds in mammals only in pathological conditions.

These vascular terminations and these coverings preserve a fine vascular and reticular structure attesting particularly the nature not simply of a supporting but of a functional quality of a much higher order. There exist in the brain of birds elongated vascular tubes terminating in the vessels by cones of implantation. These structures are here similar to those described and whirling or other abnormal forms such as described by Cajal are absent.

*Autonomous neuroglia.*—Achucarro confines himself in this resumé to the ependymal or epithelial and the autonomous neuroglia calling attention once more to the fact that the autonomous neuroglia scattered through the tissue comes from an emigration of ependymal epithelial elements. It is a fact long proved by the embryological researches of Cajal and his pupils on the chickens; but once again a parallel phylogenic evolution is found in studying diverse representatives of adult vertebrates. In the researches of the author on this subject the lizard has given the most interesting results. As will be remembered the gliatectonic is fundamentally ependymal in this animal, but already the evolution toward the migration of the epithelial cells has commenced. Thus there are found everywhere in the covering of the optic lobes, for example, little autonomous neuroglia cells, which recall slightly the protoplasmic cells known in man and the monkey, although simpler. But it is especially in the neighborhood of the ependyma that the migratory forms are found. The cells are detached from the ependyma, dividing by a



plane perpendicular to the radiating direction, progressing thus to the surface, being very numerous, and are almost the reproduction of the diagrams in the works of Cajal, Retzius, Sala, etc. The fact of the insertion into the vessels and of the ependymal neuroglia in the frog and lizard will also be one more proof of the origin and nature of the autonomous neuroglial cells. In the fishes the examples of neuroglia autonomy are not abundant. There are perhaps here and there emigrant cells in the parenchyma. They are found ependymal in the system of the optic tectum and in the white matter of *Cyprinus*, but it is particularly in the cerebellum of this species that abundant examples of this separation of the ependymal have been found. It is evident that in general the emigration and diffusion of the neuroglia cells progresses at the same time that the central nervous system grows in volume and becomes more complicated. It is interesting to find here in the cerebellum of *Cyprinus* as indirect proof that the diffusion and autonomy of the neuroglia is to a certain degree parallel to the development and the functional importance of the organ. Thus when the cerebellum of the lizard, for example, follows a manifest regression the neuroglia becomes again epithelial. The evolution of the neuroglia follows and perhaps contributes a good deal to the development of the nervous system, and this simple verification ought to suffice to attribute to the neuroglia another role than that of a supporting structure.

It seems worth while to determine if the transverse thickness of the neural tube at the level of the cerebral formations plays some part in the displacement of the epithelial cells from the ependyma. The possibility that this transverse thickness may contribute toward determining the implantation of epithelial cells in the vessels has been considered. It does not appear improbable that a similar nutritive need cause these cells to emigrate from their ependymal stratum.

*Satellite Cells and Third Element.*—Achucarro now takes up those arrangements which are constantly found in the human gliatectonic, namely the satellite neuroglia and the third or dendritic element. Since Cajal's researches made in by the Golgi method it has been the custom to call the elements which surround the neurons satellite cells. They have been much studied in both normal and pathological conditions, but it is especially Cajal's recent study with his new method and the author's pathological researches in general paresis with the same method that have lately brought to light some new faces. Achucarro does not repeat in this article the results of these researches, but notes that they have to do with a regular ar-

range in the nervous system of man and the higher vertebrates. This arrangement is not constant in all the vertebrates. Naturally when the neuroglia is not freed from its ependymal source one sees no trace of this arrangement, but even when one finds an abundant autonomous neuroglia, as in the lizard, one sees no satellite cells. Achucarro found them, though few in number, in the cerebellar valve of *Cyprinus* and one of them is represented in this article. Only having studied this question on the side, the researches in it are very incomplete, he considers it important to outline precisely the evolution of the satellite cells. Also only as a hint for new researches he mentions again that in fishes one does not find by the gold method dendritic cells nor Cajal's third element. It is known that recent researches of Cajal have made plain if not the origin, at least the very diverse nature of these elements.

It is therefore interesting to mention that they are not abundant, at least in the teleosts and that they are found in the strong white commissures and in the optic chiasma of the lizard. Here they are numerous, and it is here also that the connections of the neuroglia with the vascular apparatus are abundantly established. If like Cajal and Achucarro, one is inclined to admit that these cells come from blood vessels or from their connecting envelope, and if as one of us believes possible, the tendency of the neuroglial protoplasm towards the vessels is due to some change in the wall of the latter, it may be that the two facts stand in a certain relationship.

*Protoplasmic Neuroglia.*—At the end Achucarro again considers the evolution of the neuroglia from the point of view of the protoplasmic or fibrous nature of these elements. This division seems distinct for adult mammals, among which a great part of the nervous system presents almost exclusively the fibrous form and particularly in man where the cerebral cortex especially in its lower strata represents only cells of protoplasmic nature.

From researches made by the Golgi method and especially from those of Cajal and his pupils it is known that the ependymal or epithelial neuroglia changes in appearance in traversing nerve strata of different constitution becoming by turns stiff or fibrouslike, or velvety and protoplasmic. Müller's cells in the retina are the best example of this, but similar indications are found in the spinal marrow, and in the brain of amphibians and reptiles.

Although the gold chlorid method fails somewhat here, some indications of this fact are found. In the ependymal cells of the optic tectum of the lizard, which in the portion near the ependyma presents a vacuolar structure like that of the protoplasmic neuroglia in man.

Abundant transverse thorny ramifications help to reinforce the protoplasmic character. But it is particularly in the case of the autonomous cells that the distinction between protoplasmic and fibrous cells is important. For as the researches of Cajal and Achucarro have proved, it is often a character of correlative with the progressive development of the cerebral cortex in the animal series, as the persistence to the adult stage of the protoplasmic cells, the evolution of which perfects itself even to morphological and structural complexity of the protoplasmic cell of the monkey and of man. The rabbit, the cat and even the dog, do not show this cellular type well developed. Likewise the autonomous cells which are found in fish are extremely simple and primitive, and the silver tannate method shows that at least in the optic lobes it is a question of frankly fibrous cells. In the lizard the little autonomous cells of the cortex of the optic tecta are for the most part protoplasmic but of a type very similar to the embryonic cells described, for example, in Ammons horn of a newborn kitten. The protoplasm is very poor and frequently polarized and one finds no vacuoles. But on the other hand the author's histological researches with birds show that here the development of protoplasmic cells is extreme, so that sometimes in studying the nuclei of the base, which constitutes the most important part of the bird's brain, one believes oneself in the presence of a human gray matter structure. Likewise in birds the connections of the neuroglial cells with the vessels are more extended than in other places because of the formation of the protoplasmic coverings enveloping the vessels. Here, as in man, the impression of a glandular structure is very strong and one cannot doubt from the histological data that if this gland exists it is a vascular blood gland.

The idea of the secreting function of the neuroglia, admitted in hypothesis by Nageotte and later by several other authors, is only reinforced by Achucarro's researches. Very probably the ependymal epithelium constitutes in part a gland from the beginning of the formation of the neural tube, a gland which empties its secretory product into the same tube which at a certain stage of development will open out on the exterior by means of a neuropore.

The appearance of the ependymal epithelium in the *Amphioxus* and especially in fishes makes one tend towards this hypothesis, and the fact that several glands, such as the epiphysis, the epithelium of the choroid plexuses, develop from the neural tube makes one accept the idea without any repugnance. The extraordinary importance acquired by the ependymal formation in certain parts of the encephalon (optic tectum of the fish) almost makes one fancy a

condensation of the glandular structures under the form of an individualized organ. At this epoch of development the neuroglial gland would come in contact with the pial mesoderm and would empty into the cerebrospinal fluid of the ventricles or of the neural tube, which, open at first, is now closed. In his recent work on the morphology of the neurons in the invertebrates Cajal, accepting Achucarro's idea of considering the epithelial neuroglia of the lower vertebrates as a tubular ependymal glands, tends to attribute to this secreting structure an important role in the elaboration of the nutritive center of the nerve elements. The ependymal glands and the ependymal spaces would form thus the most important nutritive source for the neurons, the cellular bodies of which would be forced not to abandon the ependymal vicinity and the form of which should be on that account even monopolar. According to Cajal this is the case in the nervous system of the *Amphioxus* and *mutatis mutandis* it is the case also for the monopolar neurone of the invertebrates although here the nutritive source is not central but peripheral on the contact surface of the ganglia with the ambient mesoderm. The penetration of the vessels in the nervous system of the higher vertebrates and the vascular evolution of the neuroglia would permit the neurons to abandon their juxtaependymal or peripheral position and adopt bipolar or stellar forms, which are best adapted to their associative functions. Two factors in the evolution contribute to transform in a definitive way the neuroglial gland into a vascular blood gland; first the insertion of the peripheral or mesodermic prolongations of the ependymal cells upon the blood vessels, second the emigration and autonomous transformation of the neuroglia. These two factors provoked perhaps by the insufficiency of the nutritive connections of the epithelial cells with the mesoderm, in proportion to the increase in thickness of the walls of the neural tube in certain places (encephalic) are decisive on the one hand in putting the neuroglia in contact with all the vascular nerve network and on the other hand in removing it from its ependymal connections. The transformation of a secreting epithelium, pouring its product into a cavity or a conduit either with or without connection with the exterior, is not new in the evolution of internal secreting glands. The phylogenetic or embryological history of several of these glands shows us striking examples of this (epiphysis, thyroid, islands of Langerhans, etc.). Now, in order to admit the possibility of the secreting functions of the neuroglial cells, relying on histological data, it is at least necessary to recognize in these cells a protoplasmic structure young and non-fibrous as found distinctly in the human

cortex, and as found it also in the brain of birds. The protoplasmic character alone can make one believe in an important and active function like that of secretion. It is also that in considering how the modern authors explain it otherwise that even the fibrous cells are covered by a restricted protoplasm, it is necessary meanwhile to admit that the secretory function of the neuroglia must have been developed principally in certain parts of the nervous system and should be very different according to its importance in the different species. The histological verification of a fact appearing late in evolution throws perhaps some light on the functions of the neuroglia, namely the connections of the satellite neuroglia cells with the nerve cells. Moreover, as is recognized by many authors, the neuroglia constitutes an important means of union between blood vessels and the most important elements for the nerve functions, the nerve cells. This intermediary role of the neuroglia has been admitted by Alzheimer in the pathological processes and by Lugaro in his hypothesis on the function of the neuroglia. This connection between nerve cell and blood vessels must have great functional importance. The neuroglia facilitates thus the nutritive processes of the nerve elements, and it is very probable that we are in the presence here of a factor acting even on the development of nerve centers. But if in addition with Nageotte, Mawas, Cajal and Achucarro one attributes an internal secretion to the neuroglia, one must almost admit that this internal secretion, due to the close connection of its productive organ with the nerve elements, must possess also some function in connection with the specific functions of the nervous system and very especially with the gray matter. For it is known that the nerve activity of an associative nature produces by itself a certain somatic reverberation and that this reverberation increases in an extraordinary way in the process of an affective nature, called on this account emotional. This somatic echo on the vasomotor muscles after effect reaction, on the glands especially and also on the respiratory muscles and on the skeletal muscles is too well known and studied to insist on its importance. One knows also that hypotheses, which have not suffered entire rejection like those of James and Lange, make the somatic echo the essential causal stimulus of the emotions.

Whether one admits one or the other of these hypotheses proposed to explain the genesis of the emotions, or even if one is not satisfied with any of them, one is nevertheless forced to admit that perhaps the most essential character of the mental processes that are called emotional consists just of this somatic echo. For in

recent researches, especially those of Cannon, one sees the growing importance of the changes in the composition of the blood and particularly of its content of glucose and adrenalin in the emotions.

It seems proved then that in the emotions there is a hyperactivity of the suprarenal glands. On the other hand many former researches and the more modern ones of Crile admit the excitation of the thyroid activity in the emotional processes. Here therefore are two organs of the endocrine system functioning in an abnormal way in the emotions and in connection with the respiratory and vasomotor manifestations, which are in their turn reactions of emotions so extremely fine that if these latter can be perceived in a subjective way, they already betray themselves by their physical symptoms. Apparently these expressive phenomena are united to the affective psychic processes in a manner just as constant as are the sensorial excitations to the sensations" (Wundt). It would seem then justifiable to admit as a working hypothesis the idea that the prooplasmic neuroglia, considered as glandular by their structure and their vascular connections, placed in close connection on the one hand with the associative nerve elements, and on the other hand with the vessels, can in certain moments of nerve activity throw into the blood, hormones which would serve to bring about the other endocrine manifestations essential in the emotions, like hyperthyroidism and hyperadrenalism.

## Current Literature

### I. VEGETATIVE NEUROLOGY

#### 1. VEGETATIVE NERVOUS SYSTEM.

**Pauchet, V.** GASTROPTOSIS. [Presse Médicale, April 11, 1918.]

Pauchet warns against considering gastroptosis a purely local lesion, or mistaking it for salpingitis on the basis of a sensitive colon, wandering kidney if the cecum is distended and painful, gastric ulcer when there is pain at once after eating, or chronic appendicitis because there are pains in the iliac fossa. Useless operations which increase discomfort and suffering have resulted from such mistaken diagnosis as well as from failure to consider the gastroptosis as a far more complex pathologic condition. The full history of the case should be taken and Roentgen examination both reclining and standing. Bismuth serves to discover the location and degree of reducible or permanent kinks of the digestive tracts.

The condition may require months or years in order to reach all the sources of disturbances. Treatment may involve liver, suprarenal and other organotherapy, because of insufficiency of these glands, also physical culture, outdoor exercise, psychic reëducation, massage and general hygiene. The abdominal orthopedics necessary require the surgeon, the physician, the masseur and the physical culture trainer. The operation which Pauchet uses to bring into place the stomach and the transverse colon is as follows. He sutures the transverse colon to the lower margin of the stomach and then draws up the stomach into the proper shape and size, quilting superficially the length of the anterior stomach wall not entering the pylorus region or the greater curvature. The threads are brought out through the skin surface and adhesion is induced by painting with iodine. A bandage first applied under roentgen rays is of great service. Improvement has been obtained in weight and general condition, with marked improvement in pulse rate from the combination of operative with other orthopedic measures, where operation alone had failed to give permanent relief from all the disturbances.

**Ingals, E. F. and Meeker, W. R.** ANGINA PECTORIS. [Journal A. M. A., April 6, 1918.]

After referring to the recent work of Sir Clifford Allbutt on the subject, the authors report a study of a case of this disorder, based on Ingals' experience with 1,396 cases of heart disease, exclusive of hospital

and dispensary practice. Such being the case, he could not make any extensive studies of pathologic changes, as Allbutt did, but from the clinical standpoint alone he feels confidence in his own observation and in his own views of the subject. Angina pectoris is defined as "a paroxysmal painful disease of the circulatory organs in which the pain is usually located near the base of the heart, over the large arteries and in the shoulders, neck and arms, most frequently confined to the left side, but often in the right side. It is often attended by dyspnea and commonly by mental depression or a sense of impending death, which must not be confounded with fear. It is to be questioned, the authors say, whether the group of symptoms attending angina pectoris should be dignified as a distinct disease, especially since the pathologic findings are so variable; yet the variation is much less than in many other affections recognized as morbid entities. Most authors also recognize false or mock angina, which is of nervous origin and commonly associated with intercostal neuralgia. It is not a serious affection, though the symptoms are much like those of true angina. One must carefully distinguish between these purely nervous affections and those of mild true angina associated with arterial or heart diseases. Ingals thinks that most cases of pseudo-angina are milder cases of the true disease, and that pseudo-angina is a rarer affection than has been supposed. Many authorities recognize angina sine dolore, which is accompanied by paroxysms of cardiac dyspnea, but not attended by pain, or at least, not by severe pain. He thinks this classification would be changed by a careful study of the facts presented. True angina is usually supposed to depend on disease of the coronary arteries, affecting nutrition of the myocardium, but if, as some hold, it more commonly follows disease of the aorta and possibly other arteries, one can better understand the diverse seats of pain, and why the heart is often not itself disturbed. Myocardial disease is not essential to angina pectoris, although it often exists, and it also seems proved that angina does not occur in the majority of cases of coronary occlusion. As regards the mechanism of the pain, it is probably due to excitation of the nerve end organs in the sheath of the ascending aorta and other large arteries. It is the kind of pain that attends diseased fibrous tissues. Ingals finds it more common in men than in women, and between the ages of 50 and 70 years. The use of alcohol, tobacco and coffee, predisposes. Syphilis is said to be a factor also, especially in those under 45 years old. Typhoid, rheumatism, gout, and influenza predispose in older patients. Angina pectoris is benefited by exercise in some mild cases which are probably of gouty origin. Arteriosclerosis and high blood pressure after 50 years are etiologic factors, especially with aortic disease, other heart troubles are also associated with it. Angina pectoris and aneurysm are often coincident, though the angina often appears a long time before the discovery of the aneurysm. It is a curious fact, that out of thirty-two cases classified as true angina, nine were in



physicians, but he attaches no great significance to these figures, except that they serve to emphasize the danger of drawing conclusions from insufficient data, and are at least suggestive of syphilis as an etiologic factor. The exciting cases are vasomotor disturbance, worry, muscular effort or annoyance in some instances, and pain frequently comes on during or after a meal. Minor attacks are brought on in the same way as the more severe. The spasm of the coronary arteries as well as their actual disease is questioned as an exciting cause, and cramp of the heart and distension of the left ventricle or undue systolic effort are also discredited. Tension of fibrous structures in any part of the body may cause pain, and this tension is the principal factor in angina pectoris. The physical signs are not characteristic, but there is often moderate enlargement of the aorta and sometimes of the heart. The blood pressure may be excessive, but usually is not affected, and the pulse may be slow in rate. Profuse sweating, fever, restlessness, tremor, flatulence and gaseous eructations and dyspnea are mentioned as more or less common symptoms. The pain in angina pectoris is usually paroxysmal and seldom a steady grind. Sometimes it is very severe. Its location is often in the chest, but it may occur in the arms, neck, and other locations. Angina without pain is comparatively rare, but may be quickly fatal. Fear to move is common and a feeling of impending death may occur. Ingals gives the details of a rather instructive case of a physician. The pain is usually located in the upper part of the sternum over the aorta, and if we assume that it must be over the precordia and down the left arm, our diagnosis may mislead. The relief of pain by nitrites is usually considered a diagnostic feature; but this is not necessarily the case. In the milder forms of the disease suitable care and treatment may prolong life for many years. His earlier view as to the fatality of the second or third attack, has been modified by later experience. While the nitrites are the most valuable remedies, they are commonly given in insufficient doses. A useful drug which was largely employed by the physician patient whose case is reported was 1/100 grain of nitroglycerin. Sometimes four or five a day are most satisfactory. Large quantities seem to have been taken in some cases. One patient is told of who took 100 in one day. Ingals has found it is a good plan to give 1-100 grain or more in consulting cases and watch its effects. If the attack is prolonged or very severe, morphine and atropine are commonly given. Other remedies are also given. The paper is summarized by the authors as follows: "The pain in angina pectoris is not usually in the heart and left arm, but rather along the course of the aorta or larger arteries. The pain appears, at least in many cases, to have no relation to the condition of the myocardium or to the obstruction of the coronary arteries. A more hopeful prognosis than that of the usual conception of this disease may be assured under proper care and treatment, a very important part of which is abundant rest with heart tonics as needed. The sublingual admin-

istration of fresh hypodermic tablets of nitroglycerin in large amounts to relieve pain is of great value. The failure of nitroglycerin is most often due to the wrong mode of administration, deterioration of the preparation, and inadequacy of the amount.

**Marine, D., Rogoff, J. M. and Stewart, G. N.** PHRENIC AND CERVICAL SYMPATHETIC UNION AND THE THYROID. [Am. J. Phys., Feb., 1918.]

The experiments on the effects of fusion of the anterior root of the phrenic nerve with cervical sympathetic on the thyroid function in cats represents an effort to repeat the studies of Fitz, Binger and Cannon. There were no symptoms of exophthalmic goiter in any of the animals. In several of the animals electrical stimulation showed that functional union had occurred between the phrenic and the cells of the superior cervical ganglion innervating the iris and the nictitating membrane. A tonic dilator effect was also shown in several, that must have been exerted through the phrenic on the pupil of the operated side. This follows from the fact that in animals in which it was shown by electrical stimulation central to the synapse that the phrenic caused dilatation of the pupil and the sympathetic did not, the pupils on both sides were equal. It was proved by nerve section that the phrenic was exerting a tonic dilator effect, for when the anterior phrenic root central to the synapse was divided the pupil on that side became smaller than the other and remained smaller. In several cats stimulation of sensory nerves and its effect on the pupil was noted. Dilatation occurred in the same degree at the same time on the operated side as on the normal side. Although very carefully looked for no respiratory hippus was seen in any of the animals. There does not seem to be any obvious reason why a rhythmical change synchronous with the respiration should not be present if the dilator innervation is due to impulses from the respiratory center. It was not seen in any of the cats. Exophthalmos did not develop in any of the animals. The thyroids were always of the same color and equal on the two sides. No difference was observed between the thyroid on the operated side and that on the normal and variations in the weight of the suprarenals were within the average.

**Klinkert, H. D.** CONSTITUTIONAL EOSINOPHILIA. [Ned. Tijds. v. Geneesk., Dec. 8, 1917.]

The gouty, the neuro-arthritis diatheses, asthma, urticaria, etc., as the result of a constitutional abnormal condition of the vegetative nervous system are better understood, according to this investigator, by the study of familial eosinophilia. This is indicative of the disturbance in the innervation. In adults this may be manifested by asthma, hay-fever, urticaria, epilepsy or gout, while children present more likely the exudative diathesis. All these disturbances are better understood in the light of this disturbed innervation and their appearance in families with constitutional eosinophilia supports this causal relationship.

A nervous-gouty catarrhal state includes thus asthma and hay-fever and gouty joints, and an acute attack of gout is an acute trophoneurosis. Since the gouty tendency finds its chief field in the kidneys there is added to the pathology of gout the retention of uric acid. This is not the cause of gout, as has been affirmed, but is secondary to the neuro-arthritic diathesis. It is an important factor in establishing the vicious circle in which the attacks of gout appear. Urticaria may be an equivalent of the attack. Between the acute attacks diminution in the elimination of uric acid signifies the pathologic condition of the kidneys. Men are more subject to asthma, gout and hay-fever than women, perhaps because in the former the thyroid is less active. This is supported by the fact that the gouty tendency becomes more manifest in women after the menopause when the thyroid is doubtless less active. Further support of this theory comes from Falta's report that the elimination of uric acid is usually low in exophthalmic goiter, and Trousseau's statement that an acute febrile infectious disease causes asthma, enuresis nocturna and similar neurotic conditions to disappear. This is due to the action upon the sympathetic nervous system, which, over-stimulated, counteracts the hitherto abnormal influence of the autonomic nervous system. The pathologic hyperfunctioning of the latter determines the gouty constitution, is manifest in sluggish metabolism, called by Landouzy the *diathèse bradytrophique*, and summarized by Klinkert as the eosinophilic neuro-arthritic diathesis.

## II. SENSORI-MOTOR NEUROLOGY

### 1. CRANIAL NERVES.

**Reymond, R. duBois.** THE BEHAVIOR OF FISH TO WATER MOVEMENT. [Arch. f. [Anat. u.] Physiol., 1917, pp. 30-36.]

This important problem of equilibration, of reaction to compression of water or of gases as in shelling, but more particularly to sound detection in water (submarines) is furthered somewhat by these experiments. Technically it is a contribution to the question of hearing by fish. A large steel plate was made to vibrate yielding, so as to give, in air, a sound like a steam whistle. This was immersed in a lake, and perch were attracted to its neighborhood by ground-baiting. The fish were apparently unaffected by stopping or by starting the vibrations unless in very close proximity to the plate, and were even then only slightly disturbed. The author's hand (or foot) immersed in the water during vibration was affected as by a faradic current until it (hand or foot) was completely wetted, when the sensation of vibration vanished completely. The sensation was consequently attributed to air adherent to the skin. Immersion of the head was, however, hardly bearable on account of the loudness and unpleasant timbre of the auditory sensation. Immersion of the trunk near the source of the vibrations gave

rise to rumbling sensations ("Gurren") in the abdomen. The author regards the sensations of the fish as akin to these, rather than to the auditory sensations of the human subject with head (and ears containing air) immersed in water near vibrating plate.

**Rimbaud, Vernet.** JUGULAR FORAMEN SYNDROMES. [Bull. d. l. S. M. des Hop., Vol. 42, 1918, No. 14.]

Injury to the pneumogastric and spinal nerves as they emerge from the jugular foramen gives rise to a definite syndrome here discussed. Hypertrophied glands are one of the most frequent causes of compression. There is characteristic paralysis of the superior constrictor of the pharynx, evident when the tongue is held down with the spatula. In phonation, the posterior wall of the pharynx is drawn toward the sound side. Swallowing of solid food is difficult. The paralysis may be so complete that swallowing is impossible. In the case described the patient twisted his head toward the side affected, to aid in swallowing. The syndrome had resulted from a shrapnel wound in this region which had not directly injured the nerve structures but probably gave rise to a compressing hematoma.

**Nicholas, A.** NOTE ON THE NERVUS TERMINALIS. [Bll. de l'Acad. de Méd., 1918, LXXIX, p. 250.]

Nicholas has studied the nervus terminalis in man, and also in many specimens of the chimpanzee and gibbon. Most of its terminal filaments go to that part of the mucosa of the nasal septum which is anterior to the area supplied by the vomero-nasal nerve; a smaller number are intermingled with the filaments of that nerve. The nervus terminalis is present in all vertebrates from Selachians to man; it is as definite in those forms where Jacobson's vomero-nasal organ is poorly developed as where it is highly developed; it is present equally in osmatic, microsmatic, and anosmatic animals. Nicholas confirms the presence of numerous microscopic ganglia on its course, in addition to a definite "ganglion terminale." He points out that from its great antiquity and its high degree of development in higher animal forms we must decline to look on it as having undergone any reduction in its evolution.

LEONARD J. KIDD (London, England).

## 2. PERIPHERAL NERVES.

**Kent, Syndey.** THE ASSOCIATION OF NEURITIS AND MYALGIA WITH SUB-NORMAL TEMPERATURE. [Practitioner, 1917, XCIX, p. 575.]

Kent, writing in an English journal, finds that the temperature is invariably sub-normal in lumbago, sciatica, and in all neuritis which is not complicated by, or symptomatic of, some febrile disease. He rejects the whole salicylate group of drugs which depress the temperature still lower: though they often give relief, he regards them as

"placebos." He goes on the rational plan—as far as war conditions permit—of re-heating the blood stream. So he gives fatty foods, as bacon, cream and butter, supplemented by olive oil by mouth, a table-spoonful after each meal. Cases are recorded which show cure in the course of a few days to a few weeks. He has noted a great increase in the diseases named, owing, he believes, to the enforced reduction in diet during the present war.

LEONARD J. KIDD (London, England).

**Langley, J. N., and Hashimoto, M.** ATROPHY OF DENERVATED MUSCLE. [J. Physiol., 1918, 52, pp. 15-69.]

This contribution essays to clear up the effect of the usual methods of treatment on the atrophy of denervated muscle. Rabbits were used and comparisons were made (1) of the weights of corresponding muscles on both sides after bilateral denervation, one side only being treated; and (2) after unilateral denervation by comparing the weights of the corresponding normal and denervated muscles in treated and control animals. Various sources of experimental error in both methods were considered, including variations in weight of corresponding muscles, trophic changes with accompanying inflammation and connective-tissue formation, difference in the rate of atrophy, etc. In 17 weighed animals the maximum difference in weight of 153 corresponding muscles or groups of muscles in the leg was 9.1 per cent.; the difference was less than 4 per cent. in 75 per cent. of the cases. In a similar comparison made after about 3 weeks' bilateral denervation (sciatic or its main branches) in 6 animals on 23 muscles the difference was less than 4 per cent. in 43 per cent. of the cases, the greater range of variation being partly due to coincident inflammatory change. The difference in the atrophy of the several muscles probably did not exceed 1 to 1.5 per cent. Section of the Achilles tendon in 3 unilateral and 3 bilateral denervated cases caused varying degrees of connective-tissue growth, but no uniform effect on the atrophy. Continuous extension of the ankle-joint in 4 experiments for 5 to 6 hours daily caused a great increase in connective tissue and an independent increase in the weight of the muscle. Fibrillation of denervated muscle was only completely stopped by ionization with  $\text{CaCl}_2$  with a very strong galvanic current, in the anesthetized animal. In 3 experiments ionization with  $\text{CaCl}_2$  once or twice a day caused trophic changes in the skin, with deposits of calcium, but no definite effect on the atrophy. A similar but lesser effect occurred in 3 experiments with Ringer's solution, while a beneficial effect on the atrophy was noted in 1 of 4 experiments with  $\text{KCl}$ . Rhythmic flexion half an hour twice daily for 18 days in one rabbit and massages for similar periods for 15 days in another animal caused a slight balance in favor of the treated side. As a result of unilateral denervation in 8 rabbits the atrophy at the end of 3 weeks in nearly all the cases was greatest in the gastrocnemius and plantaris, and least in

the ext. com. dig., the main factor apparently residing in the nature of the muscle itself. Langley and Katos curve of the rate of atrophy probably falls too slowly in the second and third week. A general but not detailed correspondence was found between fibrillation and atrophy seen at death; it was greatest in the gastrocnemius and plantaris, and usually weakest in the ext. com. dig. None of the methods of treatment appear to have more than a slight effect in delaying the atrophy of denervated muscle, with the possible exception of a slender benefit from ionization with a potassium salt. [Physiological abstracts.]

**Cathcart, E. P., Henderson, P. S., and Paton, D. Noël.** CREATINE OF SKELETAL MUSCLE AFTER DENERVATION. [J. Physiol., 1918, 52, pp. 70-74.]

In this series of experiments the sciatic nerve was cut in cats and rabbits, and the muscles so denervated were examined. No change occurred in creatine content until the fifteenth day after the operation, when the reaction of degeneration was well established; the creatine then steadily decreased. This lends no support to the view that creatine is related to sarcoplasm. [Phys. Abst.]

**Lortat-Jacob and Hallel.** LIGATION TREATMENT OF CAUSALGIA. [Presse médicale, March 28, 1918.]

These authors report the case of a wounded man with associated paralysis of the right median and ulnar nerves and marked and persistent sensory disturbances of causalgic type in the median distribution. A vascular injury had necessitated ligation of the brachial artery. Galvanism, the ethyl chloride spray, and salicylic ionization having all proven useless in relieving the pain, surgical treatment was decided upon. The median was freed for a distance of five centimeters and a moderately tight ligature of No. 1 catgut placed about the nerve in its infraxillary portion. On the first day the pain was markedly diminished and on the second disappeared completely. Evidently such a ligature is capable of inhibiting or eliminating for a time the perineural sympathetic irritability and the congestion of the trunk of the nerve without injuring the nerve fibers themselves which are undergoing centrifugal repair. The procedure is simpler and more easily carried out than denudation and excision of the periarterial nervous plexuses, and deserves recognition as a radical means of relief for severe causalgia in certain cases of median paralysis. It can be accomplished under brief general anesthesia with ethyl chloride.

**Saporte.** MALARIAL POLYNEURITIS. [Bull. Soc. Méd.-Chirurg. Indochine, 1916, Dec.]

An interesting contribution to the subject of malaria and polyneuritis, now more frequent by reason of the war. The patient—a

soldier enlisted for the term of the war—had no record of any illness until he was attacked by fever in the second year of service. On admission his temperature was febrile, there was intense headache, he could not stand without support, had little command of his arms, and could not articulate or control his saliva; but all the reflexes were normal and his intelligence was not affected. Treated with intramuscular injections of quinine, and with cacodylate of soda and cinchona he made a complete recovery.

**Doi, T.** ON DIRECT IMPLANTATION OF NERVE IN MUSCLE. [*Acta Schol. Med., Kyoto, 1918, 2, pp. 125-141.*]

In this series of experiments after denervation of the gastrocnemius in young rabbits by excision of a length of the N. tibialis, recovery of function is obtained in 7 to 8 weeks if at the time of the section of its nerve the central end of the N. peroneus is stitched into the muscle. Response to electrical stimulation of the implanted nerve begins in 6 weeks, and is well developed by the tenth week, at which time motor end-plates can be demonstrated in the muscle. The newly regenerated nerve fibrils are usually seen to lie in the old sheaths of the degenerated fibers, but some are to be found in the interstitial connective tissue. If the motor nerve is cut and no nerve implanted, the resulting muscular atrophy is of simple progressive type, with an increase of interstitial fat and connective tissue; motor end-plates vanish in three days. If the operation of implantation of the N. peroneus is performed from 7 to 20 days later, recovery of muscular function commences in 85 days, and if left over till 60 to 75 days, there are no signs of recovery till 130 days after the secondary operation, but it does return if the muscular degeneration was not too profound. Regenerating fibrils do not readily grow except into the sheaths of old degenerated fibers; hyper-innervation by ingrafting of a second motor nerve was not found to occur in experiments lasting up to 85 days. In these experiments the central end of the N. peroneus was implanted into the gastrocnemius, and the N. tibialis was cut from 1 to 5 days later. When examined there were no end-plates to be found in the muscle, and stimulation of the implanted nerve was without effect. [*Phys. Abst.*]

## Book Reviews

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**Brown, Sanger, II, M.D.** THE SEX WORSHIP AND SYMBOLISM OF PRIMITIVE RACES. An Interpretation. Boston, Richard G. Badger; Toronto, The Copp Clark Company.

For one who has come upon a varied symbolism in dreams and active still more in the painful disturbances underlying psychoneurotic and psychotic manifestations, this small volume will have a particular interest and value. A brief but wide survey is made of the value of sex in primitive and ancient religions, when it formed an important and seriously accepted factor. The symbolisms in which it expressed itself are also well considered. This fundamental feature of religions is followed down to the time of its decadence, when having lost its original constructive import, it degenerated to perversities and excesses or marked a regression or a standstill in human progress.

This course in pursuing the study of sex worship and its symbolisms is of suggestive and illuminating value to the psychiatrist who finds in these patients the same sort of progress or retardation through such successive stages. It is necessary, since these things do play a very marked rôle in psychic disturbances, to appreciate both the constructive and destructive force of the same as they belong in the development and history, racial or individual, of the psyche. There is a tendency in this collection of material to separate off rather too distinctly this phase of religion and of thought from the whole unity of human expression, in which it alone has expression and development. Not sufficient emphasis is laid upon the one forces of energy striving coming up through all this. Also there is a division of the rites and the symbolic activity relating to the nutritive element from those relating to the reproductive element, which history and individual thought do not seem to bear out. The book offers however, in easily accessible and very readable form, much that is an aid to the understanding of psychiatric problems, and affords likewise a valuable summary of such developmental material for any student of human life.

JELLIFFE.



# The Journal OF Nervous and Mental Disease

An American Journal of Neurology and Psychiatry, Founded in 1874

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## Original Articles

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### PALLIATIVE TREPHINING IN CASES OF TUMOR OF THE INFUNDIBULAR REGION<sup>1</sup>

BY S. P. KRAMER, M.D.

CINCINNATI, OHIO

We have for many years had the conception that the compressing lines of force in intra-cranial pressure are distributed equally in all directions. The contents of the cranium were regarded as an incompressible fluid and the lines of force in compression distributed along hydro-dynamic lines. This idea has become fixed as it were by the adoption of the word decompression for the name of the palliative operation performed for the relief of the symptoms due to increased intra-cranial tension.

I believe that the use of the word decompression is a very grave error, serving as it does to perpetuate erroneous ideas concerning the physical forces at play in the condition which it is sought to alleviate. As a result of this conception of the hydro-dynamic character of the lines of force in intra-cranial tension we have come to think that the location of the opening in the skull made for the relief of pressure, might be determined by reasons of convenience or cosmetics—that so far as the relief from pressure afforded by the opening the location was immaterial.

That this conception is erroneous is borne out by certain clinical observations in regard to the incidence of papillo-edema complicating cases of brain tumor.

<sup>1</sup> Presented at the Forty-fourth Annual Meeting of the American Neurological Association, Atlantic City, May 9, 10, 1918.

In the first place as you very well know a very considerable number of cases of brain tumor, and I have seen some of very large size, never acquire any papillo-edema throughout many years of the presence of the brain tumor.

Secondly in many cases of papillo-edema due to increase of intracranial pressure the degree of edema in the two nerves varies considerably in a given case.

Both of these facts are not consistent with the view of the hydrodynamic character of intra-cranial tension.

It is to be remembered that it is possible to displace the brain en masse when pressure is applied at any particular point within the cranial cavity.

Spencer and Horsley found that when pressure was applied to the frontal lobe such displacement of the encephalon could be brought about so that in spite of the tentorium the cerebellum could be driven through the foramen magnum. Duret found that pressure applied to the frontal region was especially lethal by direct transmission of the lines of pressure to the medulla along an axis parallel to such a line. Clinically, Horsley showed that a palliative opening of the skull over the site of a tumor afforded relief from pressure to a much greater degree, than when such opening for various reasons was not so placed.

What we chiefly seek to relieve by our palliative operations is relief of pressure on the nerves at the base of the brain—particularly that upon the optic nerves.

Three years ago I operated by the frontal route on a case of tumor of the hypophysis with typical acromegaly sent to me by Dr. Robert Sattler. A very large osteoplastic flap of the frontal bone was turned back, intending at a second operation to lift the frontal lobe of the brain and to attack the growth. The patient however was so greatly relieved in all her symptoms particularly in her vision that she declined the second operation. She has been very comfortable since then.

Since that time I have operated three more cases in the same way—namely by turning back a large frontal flap and freely incising the dura, then folding the bone flap back and suturing the skin. In this way we produce a very considerable enlargement of the cubic content of the skull cavity particularly in the anterior fossa without unsightly deformity. The scar of the incision is almost entirely covered by the eyebrow and the hair. There is no deformity of the brain in the region of the internal capsule and no possibility of a post-operative hemiplegia which not infrequently results when a large palliative opening is made in the temporo-parietal region.

Briefly let me say that in all four of these cases the relief has been remarkable. The papillo-edema has subsided, the headaches are gone and these patients are comfortable and to some degree able to attend to their duties.

It seemed to me that we had determined on the most favorable site for opening the skull in tumor of this region.

With this clinical experience in view I sought the engineers for any theoretical light that they might be able to throw on the subject. Professor Jenkins of our engineering faculty gave me what may be a valuable suggestion. I took to him a skull and showed him the location of the optic chiasm and tracts, described the brain as a gelatinous mass encased in a delicate but strong membrane, the pia mater and said: Let us assume that there is increased pressure in the cranium by reason of a tumor—that the pressure is transmitted to the optic nerves—that by making an opening in the frontal region I obtain more relief of the pressure on the nerves at the base than if the opening is made elsewhere—Can you give me any reason why this should be so?

After a good deal of thought he suggested the following: This brain mass enveloped in the membrane, if given a chance by removal of a considerable part of the skull wall, might move in a sliding and rolling way. And by means of a large frontal opening the brain might roll forward so that a larger portion of it might come to rest upon the higher shelf-like floor of the anterior fossa and this would certainly take more pressure off the optic nerves than a displacement in any other direction.

## A CASE OF CEREBRAL EXHAUSTION MISTAKEN FOR ONE OF PARESIS<sup>1</sup>

BY THEODORÉ DILLER, M.D.

PITTSBURGH.

In a recent report, Dr. J. Ramsey Hunt<sup>2</sup> calls attention to cases in the army which he had examined exhibiting symptoms resembling paresis and which he considered to be cases of exhaustion. He stated he had never seen a similar case in his private or hospital practice.

It has been my own experience on a few occasions—perhaps not more than two or three times—to have seen cases of profound cerebral exhaustion which, for a time, I considered to be cases of organic disease; and in one instance I, for a time, believed a profound case of psychesthesia to be a case of brain tumor.

I have not seen any such case in a number of years; and so deem worthy of record as a further contribution on this subject (with Hunt's report in mind) a case of this sort at present under observation.

CASE I. A man aged thirty; hotel business with his father; married five years; two children. He smokes a great deal; drinks only a little. He was brought to me by his mother who notes that he looks tired all the time. She states that for a number of weeks he has been forgetful. She says she must tell him things over and over again. He often repeats himself within five or ten minutes. He is nervous also as shown in his handwriting. These symptoms have been developing for several weeks past.

At the age of four he suffered a severe attack of scarlet fever which left him with a discharge at one ear, which, despite treatment from a number of physicians, continues up to the present time.

Upon examination the patient looked tired, weary, stupid and heavy. His face lacked expression and was suggestive of that seen in myesthesia; it exhibited marked facial tremor; articulation was slurring in ordinary speech and this became marked when he attempted to repeat the ordinary test phrases. He writes laboriously and with great effort and handwriting exhibits a marked tremor.

<sup>1</sup> Case presented in brief in discussions in Section of Nervous and Mental Diseases at meeting in Chicago, June 12, 1918.

<sup>2</sup> JOURNAL OF NERVOUS AND MENTAL DISEASE, March, 1918.

In a mental way the patient is dull, languid, stupid, apparently disinclined to make any effort, even in conversation. There was no euphoria.

Wall

This is a specimen of my handwriting  
March. 22, 1918

Walter Cohen

Nine times nine equals  
Eleven times eleven equals.

8245715  
93240708  
2912317  
-----  
0

8245715  
93240708  
2912317  
-----  
50452100

I sent him to St. Francis quite confident that in spite of the fact that the knee jerks and pupils reacted normally that we should find

St Francis Hospital.  
April. 27, 1918.

Dear Friend Dr. Heller,

By your request for me to write you and try better before I leave the hospital, I will try to think up enough to take up a few drops of ink and some space on this card. As you know it is pretty hard to write much of any thing of interest as I do not get a chance to see much more than funerals across the way and the nurses when they come to my room. Well Dr. I must say that I am certainly glad I came here when I did for it sure has

the laboratory evidence indicative of syphilis. Much to my surprise the examination of the blood and spinal fluid were entirely negative.

Now I began to make a reëxamination of the man. Gradually it dawned on me that I was dealing with a case of cerebral exhaustion, rather than paresis. It was then that I read Hunt's report. The case then appeared to me quite clear.

To make a long story short, the patient has steadily improved since he entered the hospital about five weeks ago. The defect of articulation, so prominent at first, is now scarcely noticeable. The improvement in his handwriting is perhaps even more marked. At first it showed a very marked tremor and many words were misspelled. Recently a four-page letter which he produced for me exhibited handwriting which is about normal. Perhaps the most striking change is in his face which now lights up with animation and no longer exhibits the ironed-out expression which it presented when he first came to me.

Only recently I learned from the patient a further important item of history which was not elicited when I first saw him which is, namely, that he had been working twelve to fourteen hours a day steadily for many months before I saw him as a clerk in the hotel. He said that he was "dead tired" all the time.

This case carries with it its own comment, I think. I need hardly say anything further.

## IRRIGATION OF THE SUBARACHNOID SPACE<sup>1</sup>

BY L. B. ALFORD, M.D.

The classical experiments of Key and Retzius (1) demonstrated that the subdural and subarachnoid spaces of the spine are continuous with the respective spaces of the cranium, and a number of subsequent investigations have shown that substances readily pass in these spaces from spine to cranium and in the converse direction. It is now generally believed that in life the subdural space exists merely as a capillary space, the arachnoid everywhere lying in contact with the dura, and that the cerebrospinal fluid is contained in the subarachnoid space. This latter fact is probably a result rather of the position of the arachnoid in respect to the dura, however, than of the impermeability of the arachnoid to the spinal fluid, for it is common experience that when the normal relation of arachnoid and dura is altered, spinal fluid readily passes through the arachnoid (2). It is probably true that under pathological conditions, such as inflammatory processes, the arachnoid is less permeable, because in the acute meningitides the exudate is found almost exclusively in the subarachnoid space.

I have been able to find only once in the literature mention of an attempt at through and through irrigation of the meningeal spaces. Leonard Hill has this to say regarding some experiments of his: "On trephining the lamina of the vertebral column and screwing into it a tube, I have found normal saline can be driven into the vertebral canal. If a second trephine hole be made in the parietal region, none of the injection into the vertebral canal can be driven out from the hole. The mid-brain is floated up by the fluid into the isthmus of tentorium cerebelli and plugs this up, while the great brain likewise moves upwards and plugs up the trephine hole in the parietal region. If, on the other hand, the saline be injected into the parietal hole it can in most cases be driven through the cranio-vertebral canal and out of the hole in the vertebral column. The whole central nervous system can thus be freely irrigated. In some cases, and nearly always if the pressure of the injecting fluid be high and applied suddenly, this cannot be done. By the pressure of

<sup>1</sup> From the Laboratory of the Boston State Hospital. Received for publication July 25, 1918.

the fluid the cerebrum is driven into the isthmus of the tentorium cerebelli and blocks this up so that no fluid can be expelled" (3). The typical experiment given by Hill, however, was done on a dead animal and it may be that all of his other experiments were also.

Other experimental work having a bearing on these experiments may be referred to: Cushing and Week, studying in animals the manner of absorption of the cerebrospinal fluid from the cranial subarachnoid space, introduced solutions into the corresponding spinal space, constantly for several hours (4). In the course of some investigations of hydrocephalus Dandy and Blackfan injected phenolsulphonaphthalein into the lateral ventricles and a few minutes later were able to demonstrate it in fluid withdrawn by lumbar puncture (5). Keen passed salt solution from one lateral ventricle to the other in a conscious patient on whom he had previously operated (6). In a case of tuberculous meningitis Lannelongue attempted to irrigate the base of the brain with a weak bichloride of mercury solution from four trephine holes, but the patient died from hemorrhage (7). The intraventricular, subdural and intraspinal injections of salvarsanized and mercurialized sera in the treatment of neurosyphilis are now common practices. A weak perchloride of mercury solution has also been used to wash out the spinal subarachnoid space in cases of syphilitic meningitis.

*Scope of Experiments.*—At the beginning of this work it was the plan to develop a technic for passing solutions through the meningeal spaces from one extremity of the central nervous system to the other, and also to test the physiological effect of a few mild antiseptic solutions. It has been found advisable during the course of the experiments to attempt for the purpose of comparison irrigations of the meningeal spaces from below upwards, in the reverse direction and from the lateral ventricle of the brain through the spinal arachnoid space. The distribution of the solution in the meningeal spaces in these three types of irrigation has been investigated by means of solutions colored with methylene blue and by solutions of iron salts that are capable of being precipitated *in situ* by a fixing fluid containing hydrochloric acid.

In order to obtain so far as possible data for the application of the results of these experiments to the human subject, parallel experiments were done using the cadaver. As a result it is possible to reach some conclusions as to the distribution of the fluid in irrigations on the human subject and as to the technic of the operation.

*Technic.*—For the experiments on animals, cats were used exclusively. Under ether anesthesia a laminectomy was done in the



lumbar region, the dura being exposed over several segments and a circular button of bone, about 1 cm. in diameter, was removed from the parietal region of the skull, particular care being taken in both cases not to injure the dura. Then, if the irrigation was to proceed from spine to brain, a slit was made in the cranial dura just large enough to admit a light-wall  $\frac{1}{8}$ -inch black rubber tube which was inserted inferiorly from the slit. Through the spinal dura was passed a 20-gauge hypodermic needle to which was attached a small rubber tube connected with a burette. The solution was run in slowly from the burette, the rate of flow being controlled by a screw clamp on the rubber tube. The latter was some two feet long and lay coiled in a dish of water which was kept near a temperature of 54° C. Between the dish and the needle the rubber tube was inclosed in a larger tube in order to retard radiation. The head of pressure varied with the apparent need, being from 15 to 45 cm. Measures were taken to maintain the body heat of the animal.

In brain-to-cord irrigations the same procedure was followed except that the hypodermic needle was placed under the cranial dura and a slightly curved 15-gauge hypodermic needle containing fenestra was passed through a slit in the spinal dura to provide an outlet for the solution.

Ventricular injections were made by passing the hypodermic needle through the cranial dura into the brain to a depth estimated to be that of the ventricle. It has been found that even though the point of the needle does not lie exactly in the ventricle the path of least resistance for the fluid often does lead there.

This technic has been gradually worked out from a number of operations. In the earlier experiments with ascending irrigations the difficulty mentioned by Hill (3) was encountered, that is, the brain herniated through the trephine opening and stopped the flow. Attempts were made to obviate this difficulty by elevating the head of the animal, regulating the rate of flow of the solution, causing the solution to flow intermittently and placing cotton or glass wool under the dura, but all procedures were without constant success, until the rubber tube was tried. The solution often escapes around the tube, at least until the brain has pressed it firmly against the dura; and when the flow through the tube becomes interrupted, as it rarely does, it is an easy matter to shift its position until the flow is reestablished. The part of the tube lying beneath the dura contains a half dozen small (2 to 3 mm.) openings. The escape of the solution is freer if the tube is inserted downward than if it is placed anteriorly or posteriorly. The brain tissue should not

be injured when the tube is inserted. In the descending injections the fenestrated hypodermic needle must be placed under the spinal dura, else the escape of the solution will generally be interrupted.

In all experiments much care is necessary in maintaining the correct temperature of the irrigating fluid. A slight variation one way or the other at the medulla causes quick suspension of respiration. For this reason it is better not to have the solution flow too rapidly, 1 c.c. per minute being about the maximum rate consistent with safety. This precaution is less important in ascending irrigations because between the point of entrance and the medulla there is distance enough to permit of the adaptation of the temperature of the fluid to a limited extent. But in the ventricular irrigations it is most important; in fact the arrangement for maintaining the temperature of the solution, described above, is unsatisfactory in these irrigations and the animal frequently dies prematurely. A better apparatus has not seemed possible, however, with the means at hand.

Descending irrigations are liable to interruption by a plugging of the foramen magnum or incisura tentorii—it has not been possible to determine which, even from autopsies. Respiratory failure frequently follows such interruption and probably is a result of the increased intracranial pressure that follows. At such times it is generally, but not invariably, impossible to remove the obstruction by starting irrigation from below.

No mention of the arachnoid has been made in this description, and in the experiments it was not found necessary to take it into consideration. Evidently, the arachnoid offers no appreciable resistance to the passage of the solution, but whether this is a result of accidental injury or is due to natural permeability has not been ascertained.

*Distribution of Solution.*—Whatever the method of irrigation the distribution of the solution in the meningeal spaces is about the same. The entire surface of the nervous system is covered even when no more than 5 or 10 c.c. of solution is employed in the irrigation, although the superior surface of the cerebellum and of the hemisphere opposite to the cranial opening may be colored less deeply. No solution reaches the ventricles, but the velum interpositum is deeply colored. The sheaths of the optic nerves, the olfactory mucous membrane and the proximal end of the Gasserian ganglia are also stained, but no coloring of the spinal nerves is demonstrable beyond the foramina. In the ventricular irrigations the distribution over the surface of the nervous system is the same; both lateral ventricles are stained but that opposite to the side con-

taining the needle less deeply so. The third ventricle also contains the solution but the iter and fourth may or may not. Evidently, the solution is sometimes able to find its way out without passing through the fourth ventricle. It has not been ascertained by what path this occurs. Microscopical examination of sections taken from cases in which the iron solutions were used in the irrigations adds nothing noteworthy to observations already made (4).

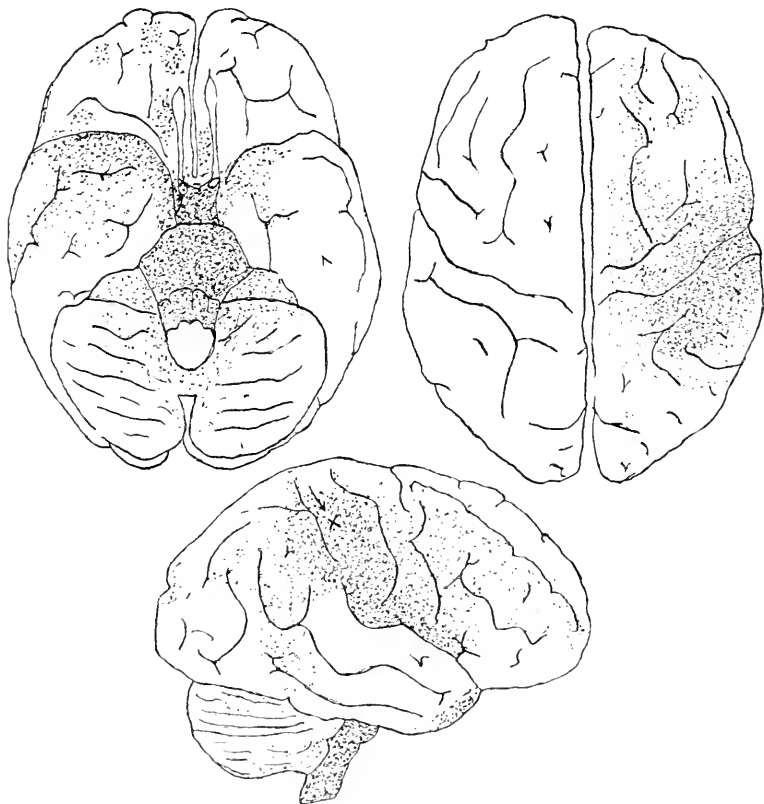
*Results of Irrigation with Antiseptic Solutions.*—This table gives the results of the tests with various solutions. Comment is scarcely necessary. A non-lethal concentration is underscored. The formalin used had been neutralized with calcium carbonate.

Exp.	Irrigation	Solution	Amount	Time of Exp.
43	Ascending	(a) Form. 0.5 per cent.	33 c.c.	23 minutes.
		(b) " " " "	8 " "	5.5 " "
45	Ascending	Form. 1 per cent.	3.5 " "	6 " "
56	Ventricle	" 0.5 " "	1.8 " "	6 " "
XIII	Ventricle	" 0.25 " "	18.1 " "	40 " "
12	Ascending	Boric, 3 " "	36 " "	31 " "
XI	Ascending	" 3 " "	37.5 " "	60 " "
27	Ascending	Potassium permanganate, 1/10,000	21 " "	56 " "
47	Descending	" " " " 1/2,500	15.8 " "	43 " "
48	Ventricle	" " " " 1/2,500	2.5 " "	2 " "
53	Ventricle	" " " " 1/1,000	0 " "	0 " "
29	Ascending	Lysol, 1/300	20 " "	78 " "
7	Ascending	Argyrol, 10 per cent.	3 " "	3 " "
9	Ascending	" 1 " "	40 " "	29 " "
55	Descending	Potassium iodide, 5 per cent.	1.5 " "	13.5 " "
54	Ventricle	" " " " 5 " "	1 " "	1 " "
10	Ascending	H <sub>2</sub> O <sub>2</sub> , 10 per cent.	1 " "	2 " "
4	Ascending	HgCl <sub>2</sub> , 1/10,000	1 " "	1 " "

*Results on the Cadaver.*—The procedures carried out on cats were repeated on the cadaver. These comprised ascending and descending irrigations and irrigations from ventricle to spine. In addition it was possible and easy, since the lateral ventricle is easily located on the human subject, to pass fluid from the spinal subarachnoid space out through a needle inserted in the ventricle. The operative procedure in these experiments is much simpler than in the case of animals. The trephine opening is easily made with burr drills and a long needle inserted between two lumbar vertebræ serves for the spinal outlet or inlet.

In the earlier experiments on the cadaver, as in those on cats, the brain persistently floated against and obstructed the trephine opening in ascending irrigations, despite all such attempts to prevent it as changing the position of the trunk and head, but the use of a fenestrated rubber tube inserted through a slit in the dura was sufficient to remove this difficulty. A 3/4-inch black rubber tube

seemed to be the best kind. The flow is freest when the tube lies over the parietal or temporal lobes but when it lies forward over the frontal lobe or backward over the occipital, the fluid will find its way to those parts of the brain. No obstruction to the flow occurred in the descending injections. From 35 to 80 c.c. of fluid escapes from the burette before it can be detected at the outlet, and from five to ten minutes are consumed in its passage.



Cadaver. Ascending irrigation. The stippling indicates the areas colored by the solution. The cross shows the location of the trephine opening.

In the cadaver a much smaller proportion of the brain comes in contact with the irrigating fluid than is the case with animals. Unless the inner end of the tube lies anteriorly or posteriorly, the fluid will flow up or down through the anterior portion of the Sylvian fissure. Plate I illustrates about the parts colored whether the flow be ascending or descending. The basal region is always deeply

colored. In the ventricular irrigations, whether ascending or descending, the fluid passes through the openings under the cerebellum and of the brain, only the basal region is stained. All ventricles are stained but the lateral ventricle on the side opposite to the ventricular puncture less deeply so.

In these experiments the arachnoid apparently never offered an important obstacle to the flow. When the solution was introduced into the cranial subdural space it usually passed downward partly under the dura and partly under the arachnoid, but in places like the occipital region where the brain lies in close approximation to the skull, the fluid passed almost immediately through the arachnoid to escape by the way of the sulci. That part of the fluid that continued downward in the subdural space usually passed through the arachnoid at the foramen magnum.

*Discussion.*—These experiments have demonstrated that it is possible to irrigate the subarachnoid space from one extremity to the other in either direction, from the lateral ventricle to the lumbar region of the spine, and in the cadaver from spine to ventricle; and also that it is possible to employ in these irrigations weak solutions of neutral formalin, boric acid, potassium permanganate, lysol and argyrol, without causing the death of the animal.

In this procedure it would seem we have a method of testing the toxicity and action of drugs in the meningeal spaces which is superior to procedures now in use because it is possible to bring the drug into contact with the entire surface of the nervous system and to maintain it there in a known concentration for considerable periods of time, and under pressure conditions not greatly different from those of the spinal fluid. With drugs in the meningeal spaces there is, of course, a double physiological action, (1) that resulting from their presence in the spaces and (2) that due to the drug absorbed into the blood stream. To estimate the former factor, it would be necessary to determine the effect after injection into the blood stream and compare it with the double action in the meningeal spaces.

It would also seem that this procedure offers a very satisfactory approach to a study of the physiology of the cerebrospinal fluid. Solutions of varying concentrations of salts, sugars or other substances can be practically substituted for the spinal fluid for long periods and the physiological and anatomical effects observed.

Whether the procedure can be applied in human therapeutics is a very doubtful question. Judging from the experiments on the cadaver, the mechanical part is entirely possible, but doubt remains

as to the ability of the human nervous mechanism to tolerate the solutions under the same conditions as animals. It must be remembered that in animals the operation is a difficult one and untoward symptoms frequently develop without warning. The experiments of Keen (6), Cushing (8) and others afford somewhat encouraging examples, but they by no means parallel this procedure. If at all applicable it would be in desperate conditions, such as septic, pneumococcus or tuberculous meningitis, for which little can be done otherwise and in which almost any risk is justifiable.

In certain cases of epidemic meningitis, too, it should be desirable to bring Flexner's serum in contact with the medulla. As shown by the experiments on the cadaver and also by the work of Dandy and Blackfan, this can be accomplished by following a subdural or intraventricular injection by lumbar puncture.

*Conclusions.*—By employing a suitable technic it has been possible both with animals and the human cadaver to pass solutions from one extremity of the subarachnoid space to the other.

In the case of animals, solutions were passed from the spinal subarachnoid space out through a cranial trephine opening, in the opposite direction and from a lateral ventricle through the spinal subarachnoid space. In the case of the cadaver, in addition, solutions were passed from the lumbar region of the spine out through a needle inserted into a lateral ventricle.

In animals the solutions came in contact with practically all of the surface of the central nervous system, whatever the procedure. With the cadaver, however, the base and only a limited part of the convexity, that in the neighborhood of the trephine opening, are touched. In ventricular irrigations on the cadaver, whether ascending or descending, only the basal and medullary regions come in contact with the solution.

The following antiseptic solutions were successfully used in the irrigations on animals: formalin (neutral) 0.5–0.25 per cent., boric acid 3 per cent., potassium permanganate 1–2,500, lysol 1–300, argyrol 1 per cent. Potassium iodide 3 per cent., hydrogen peroxide 10 per cent. and perchloride of mercury 1–10,000 were toxic.

It is the belief that this procedure offers a useful method of investigating the action of drugs in the meningeal spaces and perhaps of studying the physiology of the cerebrospinal fluid.

It is possible, also that it may be utilized in patients suffering from certain types of meningitis to clear away the exudate and to bring immune sera or antiseptic solutions into contact with the vital centers of the brain.

(I wish to acknowledge my indebtedness to Dr. E. E. Southard, of the Boston Psychopathic Hospital, for encouragement and many useful suggestions.)

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## CLINICAL REVIEW OF THE SYMPTOMATIC PSYCHOSES<sup>1</sup>

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The symptomatic psychoses are those mental pathological pictures which are of "extranervous" origin. Infections and auto-intoxications are the etiological factors.

Since Abderhalden's test and Fauser's observations a number of authorities are inclined to assume that many functional psychoses are due to autointoxication as a result of the disfunction of endocrinous glands. This, however, needs further observation. The psychoses associated with myxedema, Graves's disease, Addison's disease and chronic tetany represent distinct clinical entities and do not belong to the symptomatic psychoses. From the group of the symptomatic psychoses should also be excluded those mental disturbances which are the result of intoxication with minerals, alkaloids, etc., as we see in alcoholism, pellagra, as well as those symptom-complexes which are secondary to a number of psychoses due to gross organic diseases, as, for instance, general paresis, cerebral arteriosclerosis, fracture of the skull, concussion of the brain, etc.

From the etiological standpoint the symptomatic psychoses could be divided into two large groups: *Exogenous* and *Endogenous*. To the first group belong the infection psychoses; to the second group belong the mental syndromes which are the result of the disturbed function of the viscera.

The study of the symptomatic psychoses becomes more and more important since their relation to internal medicine and their somatogenesis become more established. The clinical pictures of the symptomatic psychoses cannot be characterized briefly, as we know very little about them. They may be very similar to those of the

<sup>1</sup> Read by title before the seventy-fourth annual meeting of the American Medico-Psychological Association, June 4, 5, 6, 7, 1918.



idiopathic psychoses: for instance, epileptiform excitement due to a toxic state may not differ from a genuine epileptic twilight state. The physiological process taking place in the symptomatic psychoses due to an infection may not differ from that due to an autointoxication; in both it may result in the production of a "tertium quid" which brings about the autotoxic state. The disturbed metabolism once established, no matter if due to agents of exogenous or endogenous origin, produces at first mental disturbances because the selective affinity between the cells of the nervous system and the toxins is greater than that between the toxins and cells of other tissues. The neuropathic taint or presence of some mental diseases increases the intensity of fixation of those "tertium quids."

**The Exogenous Group.** *The Infection Psychoses.*—The infection psychoses are those mental disturbances which accompany the invasion and proliferation of different pathogenic organisms and are the result either of the effect produced immediately by the pathogenic invader or its toxins, or are the effects produced by the absorption of the destroyed elements of the pathologic tissue.

The clinical pictures of the infection psychoses represent great variations in the degree as well as in the form. Certain manifestations occur with special frequency, for instance, difficulty of comprehension, sense-falsifications, disturbances of orientation and perceptibility, marked emotional changes or apathy, restlessness or stuporous conditions. Kraepelin divides the mental pictures occurring in the infection psychoses into three chief groups: deliria, confusions and exhaustions. While Banhoeffer distinguishes deliria, epileptiform excitements, twilight states, hallucinoses and amentia pictures with the prevalent character either of a hallucinatory, catatonic, confused or maniacal conditions. Kraepelin's classification seems to be more adaptable.

How far and whether all these forms of the pathological pictures are in causal relation with the special forms of the primary illness is not definitely established. Some authors are inclined to believe that the different forms of the psychoses of the infectious diseases cannot be differentiated from each other, nor from other mental pictures, while Kraepelin believes that we will in time learn to recognize not only the particulars of the infection psychoses in general, but also those of the special forms which develop in the course of certain infections. He bases this assumption upon the idea, that the individual infectious disease has a different toxin working upon the cerebral cortex. This is shown in the ability of our nerve tissue to manifest excessive variations in the effects produced by chemical

influences. We also know that certain infections, as for instance, tetanus and diphtheria leave our psyche almost intact, producing on the other hand grave nervous disturbances; while others, as for instance, lyssa and typhoid, as a rule, produce more or less marked mental disturbances. In the delirium grave we also see a distinct syndrome which is due to an infection, although the character of the infection is unknown yet. This permits us to assume that the refinement of the diagnosis of the psychoses of different infections through sufficient observation is quite possible. The clinical picture, according to Kraepelin, will represent not a single manifestation but a certain composition of symptoms, certain relation of partial disturbances to each other and certain mode of development and outcome. In the diagnosis we will have to take into consideration the chief illness, the history of the origin of the mental disturbances, the possibility of a mixed infection, the condition of the kidney, heart, liver and blood, and finally the gross destruction of the cortex through obstruction of vessels, through hemorrhages or softenings.

A. THE DELIRIA.—The deliria from clinical standpoint are classified into different forms.

1. *The Fever-Deliria*.—The morbid pictures represented by the fever-deliria is by no means a uniform one. Kraepelin and Liebermeister distinguish several grades of mental disturbances which correspond to the periods of development of the pathological processes in the brain, disturbances which from the manifestations of irritation gradually lead to those of inhibition and complete abolition of the psyche.

The first grade is characterized through general malaise, feeling of strangulation in the head, sensitiveness for strong sensory impressions, irritability, apathy for mental work, mild restlessness and disturbed sleep with vivid frightful dreams.

In the second grade the disturbance of consciousness is deeper and the falsifications of perception rapidly increase the defects. The ideas assume a great vividness and depend in their course more and more upon the dreamy state, departing from the influence of consciousness. Disconnected imaginations are mixed with single real perceptions, which bring the patient for an instant to consciousness. Restlessness is growing, marked exhilaration or depression takes place.

At this time the patient merges into the third grade of the delirium. Complete disorientation and deep cloudiness of consciousness set in; disconnected flight of ideas, strong and changeable outbursts of moods with raging motor overactivity develop. Fre-

quently at this period, transitory somnolence, exhaustion and uncertainty of motion is added.

In the fourth grade the excitement is reduced to carphology, the patient mutters single disconnected words or sentences, and finally sinks into a condition of continuous unconsciousness and coma.

How far the special forms of the fever processes influence or affect the form of the delirium is very little known yet. In variola, scarlet fever, erysipelas, sometimes also in articular rheumatism and pneumonia the rapidly developing confusional excitement predominates, while in typhoid the pathological picture is characterized through the delirious dazed condition and disorientation. A separate form of fever-deliria represent those occurring sometimes in articular rheumatism and scarlet fever with hyperpyretic temperature. In these cases after mild prodromata, restlessness, talking in sleep, mutism, there appears a rapid developing and extremely intense delirious excitement, which either continues until death or is transformed into deep unconsciousness.

The pathological bases of the fever-deliria are the effects produced by the infectious pathogenic toxins and the factors associated with fever. In favor of this conception is the fact that the delirious disturbances are by no means strictly dependent upon the height of the body-temperature. We see it in typhoid, for instance, where the mental disturbances are more pronounced toward the period of convalescence at a temperature between 98° and 102° and where delirium of different intensity occurs at a similar temperature; in typhoid, smallpox and erysipelas facialis the delirium is very pronounced, while in tuberculosis it is very slight. Children, women and nervous persons are easily inclined to delirium even at the slight elevation of temperature. The prognosis of these disturbances, according to Kraepelin, is very serious, and the mortality taking in consideration only the cases with marked delirium is 39 per cent.; while the mortality in the cases of delirium with hyperpyretic temperature is 80 per cent. The duration of the psychoses in most cases is over a week. The disturbances as a rule subside with the decrease of the fever; the patient becomes again organized and clear; the morbid ideas, however, remain for a certain time manifest; the patients are easily fatigued and have difficulty of comprehension, remain sensitive and irritable. In some cases the fever-delirium assumes the form or is transformed into an infection psychical disturbance, so that the common origin becomes evident.

2. *The Infection-Deliria*.—The infection-deliria comprise those forms which accompany infectious diseases and are marked through

the feverless course. This delirium shows through its intensity and peculiar mental disturbances the independence of the psychosis from the degree of the temperature. While in fever-deliria the pathological overheating of the nerve-tissue plays a serious part, here the effects of the toxins of the infections play the chief part. We ought therefore to expect that the peculiarity of the underlying process will show itself markedly in the infection psychoses.

The psychosis begins with prodromata, discomfort accompanied by a certain excitement which lasts until the active period of the disease takes place; fatigue, depression and "spasmodic elations," irritability and internal restlessness characterize the further course. In very difficult cases marked cloudiness of consciousness comes to the surface and finally the so-called *initial-delirium* develops. The initial-delirium was frequently observed in typhoid and less frequent in smallpox. Aschaffenburg distinguishes two forms of initial-delirium. In the first we deal with a quiet delirium, pronounced delusions and sense-falsifications. The patients believe to be poisoned, persecuted, condemned, forsaken, have auditory hallucinations, see threatening creatures, fire, etc. Sometimes they relate in detail their imaginary adventurous experiences, having at the same time a marked apprehension or depression. The second form can develop itself from the first and is characterized through maniacal features, which at the beginning can be very mild. The excitement grows rapidly to complete confusion; flight of ideas, sense-falsifications, disconnected delusional ideas, intense fear with senseless or purposeless motor-overactivity; the temperature may show a slight elevation and the pulse be accelerated. The desire for food or sleep vanishes almost completely, the general condition gives the impression of a grave illness.

The initial-delirium is especially intense at the beginning of smallpox. The patients are very cloudy, confused and inclined to violence or suicide; the condition may resemble the twilight state of an epileptic. Sometimes convulsions still complete the resemblance of the picture. The mental disturbance usually begins on the third or fourth day of the disease and subsides only a few days after the eruption takes place, or it continues until suppuration sets in. Some cases remain incurable with a weakened mental condition. The course of the initial-delirium represents sometimes lucid periods during which the patient remains in a stupid, cloudy state, not realizing in what condition he is in. Usually the disturbance lasts a few days only. With the onset of the highest temperature the delirium may disappear or be transformed into fever-delirium. In

every case the possibility of a fatal outcome is very great. According to Kraepelin only 40 or 50 per cent. of the cases survive or recover. The recognition of the initial-delirium represents considerable difficulties. They are mistaken for epileptic confused states, however, the course of the disease, the grave physical condition and the flight of ideas which does not occur in epilepsy will clear up the diagnosis.

The initial-delirium in typhoid is characterized through cloudiness and difficulty of orientation in the presence of a mild maniacal condition or excitement. It may remind of a general parietic, but the age and the absence of the physical symptoms will exclude general paresis. The presence of cloudiness and absence of negativismus and stereotypy would differentiate it from catatonia. The initial-deliria of typhoid and smallpox resemble to a high degree the rare forms of intermittent delirium. Here an intense, fearful excitement with deep cloudiness and regardless violence takes place. The onset is sudden, lasts a few hours and follows by a sound sleep after which there is a more or less complete inability to recall the occurrence. The delirium is sometimes accompanied by convulsions, so that it resembles an epileptic twilight state. It occurs in the tertian or quotidian and seldom in the quartan fever. This delirium is sometimes preceded by mild disturbances and is either a concomitant manifestation of the fever-period of the malarial attack, or it takes the place of the fever so that it represents the feverless course of the malaria larvata. The attacks of larvata form of the intermittent delirium are sometimes followed or preceded by a shorter or longer period of an usual attack of malaria. The cause of this disturbance is evidently the invasion of the brain vessels by malarial plasmodii. Quinine usually brings an immediate relief.

Influenza is often followed by deep disturbances of consciousness, confusion, fearful excitement and numerous sense-falsifications in the presence of a low temperature. Sometimes this condition is accompanied by paralysis of speech and deglutition, and by other paralytic manifestations. It lasts usually one week. The influenza bacillus or their products invade the brain and produce sometimes encephalitis or a brain abscess.

Pulmonar tuberculosis is seldom accompanied by delirium. A few cases were recorded where a mild confusion with auditory and visual sense-falsifications, self-accusatory ideas and changes between apathy and apprehension were observed. The delirium disappears in spite of the progress of the physical process. Sometimes such symptoms precede the development of tubercular meningitis.

In lyssa there occur deliria with extensive reflex-spasms which are interrupted by lucid intervals and continue until the fatal collapse ends life.

In septic processes there develops usually a pronounced cloudiness of consciousness with muttering delirium. The patients are unconscious or indifferent with difficulty of comprehension; they do not recognize the people or the surroundings, they whisper something disconnected, attempt to grasp something in the air or push themselves purposelessly. This condition is intervened sometimes by an attack of acute excitement. The picture is finally modified by the added gross brain effects as the result of an embolus or metastasis as for instance, aphasia, perseveration, palsies and convulsions.

A separate group is represented in the deliria which occur in chorea. We deal here with fantastic confusions, cloudiness, peculiar disconnected thinking, singular falsifications of perception and a tendency to form delusions. There are also characteristic choreic movements and emotional irritability present. While the patient comprehends singular impressions, he is very unattentive, distracted, forgetful, easily diverted and disoriented, unable to express himself coherently. He utters uniform, fragmentary sentences in which he incorporates real accidental impressions or perceptions. Single transitory sense-falsifications, mistakes in identities of people, fear of death, of being burned or poisoned and self-accusatory ideas become manifest. The ideas of persecution are indistinct and are neither fixed nor systematized. Emotionally the patients are now apprehensive, angry, irritable, frightened and then again silly, raging or threatening to commit suicide. Periods of moroseness with indifference take the place of the outbursts of rage. The picture is dominated by very intense choreic movements which continue day and night with only short remissions; the patients gasp for breath, utter loud sounds, throw things about the room, become violent and untidy; the speech is indistinct through the extra movements, gait or standing is difficult or impossible, the pupils are dilated, pulse is soft and slow. There is insomnia and the taking of food is very inhibited. The excitement remains at its height only a few days or weeks and gradually subsides. In favorable cases orientation and clearness reappear, the bodyweight increases rapidly and the sense-falsifications and delusions disappear. The patient, however, remains susceptible to fatigue and emotional changes for a long time; for a while the movements remain difficult and uncertain. Death occurs in about 9 per cent of the cases. In the chorea gravidarum

the recovery requires several months and the mortality is higher. The represented picture concerns the acute Sydenham's chorea.

Another group of severe deliria which is undoubtedly of infectious character is delirium grave. The mental picture sometimes follows a mild physical illness, tonsillitis, catarrhal condition of the intestines, obstinate constipation, etc., or it develops in the course of another mild psychic disturbance, which suddenly assumes a serious turn. The patient becomes sleepless, confused, cloudy, unable to be held on a subject; sees devils, angels, snakes, and threatening images; he hears voices, and expresses disconnected ideas of persecution, or expansive ideas. He is either apprehensive or elated, irritable, violent, praying or talking, able to utter only disconnected words or syllables. Simultaneously the patient develops an unusually intense, impulsive and frequently uniform excitement, continuously pounding or throwing himself around, struggling, screaming, blowing or clapping. These movements finally assume the character of simple cortex irritation, with twitching, grimacing, chewing movements and rolling of the eyes. The patients spit out the food which is given to them, become untidy and perish very soon. In several cases seen by the author there was distinct albuminuria with the presence of blood cells and granular casts in the urine, rapid emaciation and irregular temperature rising before death up to  $104^{\circ}$ – $106^{\circ}$ . There was a pronounced mixture of profanity and religious thoughts, olfactory sense-falsifications, somatic ideas and premonitions of death; there occurred lucid intervals during which the patient was mute and clear; those periods usually lasted a few hours only. All cases seen by the author occurred in slightly neurotic individuals, mostly men and strictly temperate. To this morbid picture there were added in some cases extravasations, fat emboli, pneumonia, grave catarrh of the mouth and nose with offensive coating and scab formation; occasionally parotitis, retention of the urine and feces, complete picture. The patients perish during the first or second week. The established absolute atony of the intestinal tract, sometimes even on the third day of the active period of the disease, marks usually the gravity of the disease; the exitus letalis in such cases is certain. Delirium grave should be distinguished from general paresis by the absence of palsies: disturbance of speech, inactive pupils, etc., as well as through the absence of complement deviation in the blood and spinal fluid. In delirium grave one finds in the blood or spinal fluid staphylococci, streptococci or bacteria coli.

The catatonic is distinguished through preserved consciousness.

declining, negativismus, pronounced sterotypy, impulsive tendency to singular and senseless actions, and finally the inadequacy between the tolerable ability for perceptions and the senselessness of expression during speech.

In collapse-delirium the cloudiness of consciousness is milder, the motor impulses are less stormy, while the sense-falsifications and delusional ideas are more pronounced; the signs of declining and flight of ideas in the speech are quite noticeable.

3. *Post-Infection Psychoses*.—The post-infection psychoses represent another group of deliria which are the result of the after effects of injuries of the cerebrum at the climax of the infectious disease. In the previous group the deliria last only as long as the toxin circulates in the body, in this group it continues after the other symptoms disappear. Single delusions, which originated during the delirium are retained in the form of "residual delusions" even after orientation and consciousness have returned. The patients relate different adventurous experiences with absolute conviction about their reality. They have different somatic ideas. Kraepelin's patients believed that their skulls were open, the nose was bitten up by a horse and again replaced, or that a friend was in possession of his nose for twenty-four hours, or that he brought, from his house, young lions to sell. These delusions are adjusted usually in the course of a few days or weeks and are identical with those which occur in delirium tremens and epileptic twilight state.

The form of the primary morbid process evidently plays a serious part, and the duration of the symptoms depend on the gravity of the effect on the nerve tissue. Such residual delusions with delirium of a post infectious origin occur most frequently in typhoid. Here also we see single sense-falsifications of hearing, sight and smell, the patient sees bodies of his relatives, hears alarms, perceps terrible stench or "feels a bullet in his head." This general feeling continues to remain after consciousness returns.

A similar mental picture represents an infection delirium which develops sometimes between the eruption-fever and suppuration-fever of smallpox. We deal here with suddenly appearing distinct falsifications of hearing and sight while no confusion or disorientation is present. The patients see people entering the room, pigeons and flowers flying in the air, they hear music, accusations or threats—a condition reminding us of an alcoholic or cocaine intoxication.

The fact that certain psychic disturbances set in after the eruption fever goes down, compels Kraepelin to assume that there is another group of deliria which begin simultaneously with the fall



of the temperature or follow the latter. He denotes this group as collapse-deliria. Here we deal with extremely stern confusions, phantastic sense-falsifications, flight of ideas, change of moods and vivid motor excitement. The onset is sudden. Sometimes insomnia and mild restlessness precede it for a short time. The patient rapidly loses orientation, the surroundings appear unsafe to him, consciousness becomes cloudy, illusions or hallucinations of grandiose character appear. The patients see crowds or faces, angels flying in their rooms; hear the poor sinner's bell sounded; believe themselves in a fabulous position in life, present at the world's destruction or their own funeral. Thoughts and speech are incoherent, flight of ideas develop and senseless alteration of verses and rhymes in talking or singing become manifest. Such mental pictures were observed after pneumonia. Regularly there are present disconnected changeable delusions, the emotional state is mostly elated and erratic; however, mild, transitory, fearful or angry outbursts may take place. Frequently we meet with an unreasonable, planless resistance. The sleep during the climax is completely abolished, or there is only a short, suddenly interrupted slumber. The patient pushes away everything, spits out the food, or swallows it ravenously. The nutrition is poor, the skin is pale and cold. The body weight sinks rapidly, the pulse is small and frequently very slow. The reflexes are exaggerated and a pronounced tremor is present. The duration of the collapse-delirium is only several days, sometimes only hours, seldom more than one or two weeks. Orientation almost always reappears suddenly after a long sleep. Suddenly they begin to realize that they are sick and accept food voluntarily. Some cases clear up for a short time in order to merge again into a confusion. The recollection about the past psychosis is a cloudy one, the patients are seldom able to relate the single delirious experiences.

The excitement is replaced by the need of restfulness. The body rapidly increases in weight. The outcome of the collapse-delirium is as a rule a favorable one, when we succeed in preserving the patient's life. The danger of physical collapse is very eminent, especially when the fundamental illness leads to injuries or complications. On the other hand in the rapid developed, apparently discouraging cases, we are surprised by the sudden favorable change.

The collapse-delirium is by no means a uniform disease. It develops apparently as the result of sudden changes in the whole condition of the infectious disease, and is observed mostly in pneumonia, erysipelas facialis and la grippe, less frequently in articular

rheumatism and scarlet fever. It must, however, be noticed that after erysipelas the numerous sense-falsifications and the delusional formations dominate the picture, while in pneumonia unconsciousness, flight of ideas and an extreme confusion prevail.

Previously the physical exhaustion, which is produced through the infectious disease, was considered as the cause of such exhaustion, hence the name—infection exhaustive psychoses. The fact that puerperium, hemorrhages, insufficient nutrition, emotional disturbances do not produce similar pictures made Kraepelin depart gradually from this point of view. He found that the most cases which he previously considered as collapse-delirium were conditions of other diseases, namely, circular or catatonic excitements. He found that collapse-delirium, as an idiopathic disease, does not occur very often and only those which follow the infectious diseases should be so nominated; moreover, he seldom met a similar mental picture as the result of a grave exhaustion which followed phthisis or carcinoma; on the other hand he has seen collapse-delirium not being associated with marked exhaustion, because it occurred in illnesses of short duration without serious disturbances of nutrition. Furthermore, the sudden onset and rapid course of the delirium would be incompatible with the idea that such a rapid and grave exhaustion could form and then vanish. Finally it was observed that the onset of the delirium was strictly coincident with the decline of the temperature, so that a certain relation between both processes could hardly be questioned. It must be assumed that with the critical end of an infection there take place certain changes in our body which also affect the nerve tissue. The absorption of the pathological products can also play a part in the production of this mental state, and it is therefore not without significance that collapse-delirium was frequently observed in articular rheumatism immediately after the decline of the swelling of the joints.

The collapse-deliria are distinguished from the fever-deliria through the following: the patients are disoriented, consciousness is less cloudy, the sense-falsifications and the delusional formations as well as the flight of ideas and pressure of speech are more marked.

It is difficult to distinguish from manic depressive insanity. The previous history, the signs of an infection, the sudden development of an intense confusion with numerous vivid sense-falsifications will distinguish it from manic depressive conditions, and instead of the overemotional happiness of the manic depressive, the emotional condition in the collapse-delirium is of a more anxious color. The

course is more stormy and shorter. The catatonic excitements are distinguished through better orientation, unnoticeable oscillations of the emotions, peculiar disturbances of will, impulsive and uniform motor pressure. The epileptic twilight states are distinguished from the collapse-delirium through more cloudiness, less sense-falsifications and less delusional formations. The past history will be the deciding factor.

B. ACUTE CONFUSION (AMENTIA).—Under this name Meinert described a morbid picture which is characterized through more or less pronounced cloudiness of consciousness with various symptoms of irritation of the sensory or motor region. Similar pictures were observed in infectious diseases. There develop acute hallucinatory falsifications of perception and motor restlessness. In favorable cases it leads to recovery in not less than one or two months. Clinically it is related to collapse-delirium which, however, is more stormy.

The disease begins with insomnia, internal unrest, anxiety, excitement, forgetfulness, and premonition of death. Patient cannot collect thoughts and complains of confusion in head. The consummation of external impressions becomes more and more disturbed; he is unable to connect singular impressions with each other or with the past experiences. However, he is attentive and makes efforts to notice the occurrences around him, but, at the same time is not able to make systematic observations. Frequently sense-falsifications develop. The emotional condition represents a crying, irritable anxiety with discomfort and suspicions, seldom stupor; at times there is present an internal tense condition with outbursts of rage. The patients are restless, attempt suicide, undress themselves constantly, hide under the bed, are crying or singing, talking, resisting and utter confused imprecations; their actions are slow and persistent, or planless and disconnected. The excitement takes place at intervals, while between these excited states the patients remain quiet or are stuporous with pronounced orderautomaty.

Besides these depressed cases of acute confusion there occurs, almost exclusively after typhoid, another type of acute confusion which is accompanied by flight of ideas and adventurous ideas of grandeur. The patients are easily set to crying and have no insight. The reflexes are exaggerated, pulse retarded, temperature subnormal, and frequent untidiness becomes manifest. The acme of the disease is reached in the first week. The stormy manifestations gradually subside; the patients become, for a while, connected in speech and thought, in order to merge again into cloudiness and

restlessness. Not infrequently, even at the beginning of the disease, there occur lucid periods for several hours or days. The recovery usually takes place gradually and, as a rule, the patients are quiet for a long time before they are in a condition to collect their thoughts or to understand the events. They usually show fatigue when they converse or write. *Exitus letalis* is rare. Heart failure, phthisis, sepsis and the possibility of suicide make the prognosis grave.

The *amentia* conditions develop most frequently in infectious diseases which do not develop stormy, namely, after typhoid, articular rheumatism, smallpox and cholera. The picture is not a uniform one. The chief manifestations, as for instance, difficulty of comprehension and thinking, the sense-falsifications and motor excitement can be of various degrees. However, the disturbances of associations, and perplexity with quiet depression or mild stupor is more pathognomonic for the confusion following articular rheumatism, while simple sense-falsifications with preserved orientation and mild confusion is characteristic for phthisis. More pronounced excitements with hallucinations, delusions and change of moods are more prominent after typhoid.

The clinical picture can represent many similarities with certain phases of manic depressive insanity. It is important to note that in manic depressive insanity we do not see a real confusion. The patient with confusion derails easily and becomes disconnected because of impediment of volition, while the depressed manic depressive has simple difficulty in thinking and perceptibility. Vivid sense-falsifications occur more frequently in *amentia* than in manic depressive insanity. The emotional state can be utilized for the diagnosis. Instead of dejection or anxiety in manic depressive we meet in *amentia* with a crying, angry mood, and instead of the tricky, extravagant or wild happiness of the manic depressive we find in *amentia* childish and senseless elation. Furthermore, the disproportion between the gravity of the disturbance of the perceptibility and attention, in spite of the mild excitement, the cloudiness and fatigue, the want of mental vivacity, the silly euphoria and the tractability without energy points to *amentia*. The vivid expansive ideas and agitation of the acute confusion could be mistaken for that of a *paretic*. The appearance of command-automatism, the occasional senseless resistiveness and also the obscure unintelligible conduct of the *amentia* patient would remind of a catatonic condition. The distinction is based upon the continuous perplexity and confusion in spite of the preserved attention in *amentia*.

C. THE INFECTION EXHAUSTIVE CONDITIONS.—Under the infection exhaustive conditions we class those psychical disturbances after the infectious diseases whose essential characteristics represent an exhaustion of mental activities. While in deliria and confusions we deal with more or less pronounced manifestations of cerebral irritation, here we meet chiefly or exclusively with psychical paralysis, which is either transitory or permanent. These conditions are more an expression of changes of subacute character which sometimes gradually assume a normal state. The psychical changes, therefore, either follow immediately the manifestations of irritation at the climax of the infection, or they develop later in the period of reconvalence even without being preceded by the delirious disturbances.

The mildest forms follow the mental and physical debility which usually take place after a difficult infectious disease. The patients do not feel free and easy after fever; they do not recover rapidly, are easily fatigued, unable to think, to read, write, or to form conclusions; they are indifferent, lie inactively in bed, and are unable to sit up without assistance. The orientation and consciousness, as well as the comprehensibility, is preserved; however, vivid hallucinations appear as soon as we close the light. There appear sometimes peculiar sensations in the body which are considered grave symptoms. The patients are emotionally dejected, frequently morose, irritable or capricious, with sudden attacks of anxiety which occur especially at night; gloomy premonitions arise: thoughts of approaching death, suspicions and fear of being poisoned. Self-accusatory ideas and attempts of suicide are not infrequent. Patients are word-stingy, very reserved, stuporous, express very few of their ideas, and only during reconvalence retail about the past delusions. They eat very sparingly.

The mildest forms occur after la grippe and articular rheumatism, in children after pertussis, tuberculosis and chorea. The duration is usually several weeks or months. The condition reminds largely of a nervous exhaustion, yet it is a grave one and does not yield to bed rest. In a number of cases the process progresses to complete abolition of psyche. The emotional condition is one of indifference or lachrymosity; the patients become inaccessible, declining, showing at times outburst of rage and profanity, there is sometimes a transitory laugh or elation. The patients are mostly quiet and mute, or restless and childishly playful. There is command-automat, but also resistance when pricked with a needle. The speech-expressions are usually disconnected and difficult to under-

stand. The sleep, as a rule, is very disturbed; emaciation is extreme; often unilateral palsies develop, defects of speech and sometimes epileptiform convulsions.

The duration even in favorable cases can be extended for several months. Under the marked gain in weight the patient becomes more active, clearer and more accessible; he starts to care for himself, to show interest in the environment, to occupy himself, although the fatigue continues for a long time. Forgetfulness, irritability and change of moods also continue until complete recovery takes place. Sometimes the body-weight increases but without simultaneous psychical improvement, and a permanent deterioration takes place. These cases represent dementia of a very severe degree and occur mostly after typhoid, articular rheumatism, erysipelas, tubercular peritonitis, smallpox, cholera and malaria.

The diagnosis is based upon the history and the course of the disease. During the period of affectivity it would remind us of a manic depressive condition, from which it will be distinguished by the defects and the debility in the domain of emotions. From the catatonic it is distinguished by the absence of negativismus.

**The Endogenous Group.**—The endogenous group of the symptomatic psychoses represents chiefly autointoxications as the result of the disturbed function of the viscera. Primarily the cause of these psychoses may be of exogenous or bacterial origin, so that the symptoms of this group may be obscured by toxic manifestations of a different origin.

The chief characteristic of this group is, that the mental disturbances subside simultaneously with the improvement of the function of the affected viscera or follow the elimination of those toxins which produced the autointoxication.

The symptomatic psychoses of cardiac type represent two forms of mental disturbances: *confusions* and a distinct symptom-complex which the author denominates as *neurasthenia cardialis*.

There are other mental and nervous phenomena which occur in disturbed and broken cardiac compensation, as for instance, reflected pain in the arms and chin and fear of impending death with peculiar restlessness; coma with epileptiform convulsions occurs in heart-block. It is not, however, in the domain of this paper to discuss all these phenomena.

**A. Confusions.**—I have observed confusions of cardiac type in acute disturbances of compensation, in acute heart dilatation or in cases of marked degeneration of the heart muscle. The symptoms are very pronounced and usually last several days without remis-

sion. The patients are completely disoriented for time and place, at times also for person. There are usually no distinct sense-falsifications. The patients are restless, aggressive and have no insight; they are emotionally slightly elated, want to go somewhere to transact business or to see their friends. The sleep is disturbed. The patients clear up as soon as the compensation improves, they regain insight, become despondent and are likely to express ideas of tedium vitæ or attempt suicide. The conduct becomes normal as soon as the compensation is sufficiently reëstablished. The content of ideas from the period of confusion could be carried over into the awakened state when the physical disturbances become more massive.

*B. Neurasthenia Cardialis.*—*Neurasthenia cardialis* represents mental disturbances of a more chronic type than the confusions. The cardiac disturbances may not show any apparent or acute symptoms of decompensation. The condition of the heart may be termed as susceptible to exertions, due usually to poor nutrition of the heart muscle or to a toxic state of the organism. The author has seen these forms of mental disturbances in cases of fat degeneration of the heart, in individuals who went through several attacks of erysipelas facialis, in septic processes and in children five or six years of age whose history was crowded with different virulent contagious diseases. In all these cases we may not find any valvular involvement. The patients are oriented in every respect; the adults are introspective, despondent, sleep is disturbed and terrifying dreams take place. Fear and premonition of death with slight precordial distress are sometimes the chief symptoms. The patients are afraid to be left alone for fear of death, they cannot think, don't care for food or believe themselves dead and sometimes attempt suicide. The children are overemotional, crying or laughing easily, are restless and usually undernourished in spite of apparent normal color and normal intelligence. Marked improvement takes place after rest is instituted and digitalis or arsenic is administered.

The mental disturbances of renal type represent, besides those usual manifestations, as for instance, coma, epileptiform convulsions and melancholic conditions, also certain fear conditions of an acute character. The patients are terrified by illusions or hallucinations of sight and illusions of hearing; the orientation is preserved almost in all fields. The patients are afraid that they are going to be robbed and that their money will be taken or that their children are going to be executed; they are afraid that something is going to happen to them and attempt suicide at every opportunity. They

take food with difficulty and nutrition suffers markedly. The patients do not express any distinct delusions and usually recover in the course of two or three weeks. These cases occur in those kidney disturbances where the specific gravity of the urine is not fixed and where the patients respond to eliminative treatment.

The patients with psychoses of diabetic type were moderately depressed with slight changes of moods. Orientation and memory was good, speech connected. They complained of having dreams or visions, that they "were tempted by the devil to commit suicide," manifested evidences of auditory hallucinations and expressed ideas of persecution. The mental attitude is that of a mild paranoid with unsystematized ideas. The patients sometimes worry about different matters and are inclined to depreciate themselves. Marked enlargement of the ego was never present. Insight into their condition returns when the patients improve.

The psychoses of hepatic type showed impaired orientation for time, place and person. Lack of insight, failure of attention with impaired sensibilities is usually marked. The memory field shows some changes with a tendency to fabrications. Hallucinations or delusions were not present.



## Critical Digest and Review

### WAR NEUROSES AND PSYCHONEUROSES

BY DRs. CHARLES ROCKWELL PAYNE AND SMITH ELY JELLIFFE

(Continued from page 332)

#### CHAPTER II. ETIOLOGY AND SYMPTOMATOLOGY

Continuing our consideration of the etiology of the war neuroses, using this term in its broadest sense as designating those disturbances of the nervous system occasioned by war, not associated with organic lesions, we may present the findings of J. Rogues de Fursac,<sup>1</sup> a prominent French neuropsychiatrist. Regarding the nomenclature, he says that we might group these conditions together under the name "traumatic psychoneuroses" or better still "emotional psychoneuroses." The etiology of the emotional psychoneuroses, he states, is simple: They require two factors: (1) a predisposed soil in the shape of an unduly emotional constitution; (2) an emotional shock. The traumatism is nothing, the emotion is everything. If emotional psychoneuroses frequently follow a traumatism, it is because the circumstances producing the emotion can also produce a traumatism; but the latter may be lacking without the psychic and nervous symptoms being thereby modified in the least. Instances of emotional psychoneuroses due solely to an emotion are not rare in the clinic. I can cite one in a young girl who, while imprudently crossing some railroad tracks, just missed being crushed by a train, but escaped without a scratch, and in whom, nevertheless, a psychopathic state developed. Emotional psychoneuroses have been seen following great catastrophes (serious railway accidents, the Messina earthquake, the great explosion in Jena, etc.). But it is mainly in the course of the present war that cases of this sort have increased.

*Emotional War Psychoneuroses. (So-Called Shell Shock.)*—Explosions of projectiles or mines are capable of producing in sub-

<sup>1</sup> Traumatic and Emotional Psychoses, So-Called Shell Shock, by J. Rogues de Fursac, M.D., formerly chief of the clinic at the Medical Faculty of Paris, physician-in-chief of the Public Insane Asylums of the Seine Department. Translation by Aaron J. Rosanoff, Major, M. C., U. S. Army. Published in the American Journal of Insanity, Vol. LXXV, No. 1, July, 1918.

jects, showing outwardly no wounds or only insignificant wounds, neuropsychic symptoms more or less severe and lasting. In the majority of these cases there is no external violence, no hemorrhage, no sign whatever of any organic lesion. The victim of the explosion, generally an excessively emotional subject, exhausted by hardships of the campaign, perhaps just recovered from a more or less severe illness, loses consciousness. For two or three days he remains in a state of confusion most often accompanied by dreams. Then he becomes lucid, but remains asthenic, emotional, living over again in his dreams his past terrors, and complaining of headaches and dizziness. This state may disappear in a few days, or it may persist for weeks or months, with or without complicating functional symptoms centering upon some organ, region or function (deaf-mutism, paralysis, contractures).

These conditions, of which some have tried to make a sort of psychoneurosis peculiar to war, were at first attributed to cerebral or cerebrospinal concussion; hence the expression shell-shock by which they have been designated. This interpretation is erroneous and the concept of concussion in relation to cases of this sort inappropriate. It can be readily demonstrated that the real cause of so-called shell-shock is not a concussion but an emotion.

Two soldiers fall sick, one following the explosion of a shell, the other following a violent emotion, for instance, the death of a close friend, killed suddenly beside him, as happened in a case I have seen. The first would be a case of shell-shock, in the improper sense in which this term has been used, the second an emotional psychoneurosis. Here surely are two etiological factors very different at least in appearance. Yet, passing into the clinical domain, as one tries to determine in what respect the cases are different, one is greatly embarrassed in the attempt. The symptom picture is the same. There will be the same course with the same prognosis, subject to the same contingencies; there will be the same sequelæ, amenable to the same treatment.

Now, identical effects necessarily imply that under a seeming etiological duality is hidden a deeper unity. In the particular case, the explosion and the emotional shock could not translate themselves into the same clinical formula except through the intervention of a common factor. This common factor exists and is none other than the emotion itself.

The explosion has not only physical effects, but also a psychic one, which consists in an emotional shock. In certain cases this emotional shock dominates the situation to the point of being alone

responsible for the neuro-psychic symptoms which a hasty and superficial consideration at first placed in a relation to cerebral concussion and it is because both give rise to an emotional shock that the explosion of a shell and a terrifying sight find expression in the same syndrome. The war psychoneuroses which have been called shell-shock are nothing but emotional psychoneuroses, and they might best be studied under the name "emotional war psychoneuroses."

The etiology of the emotional war psychoneuroses comprises, accordingly, all the factors capable of producing an emotional shock: explosions of projectiles (shells, bombs, aerial torpedoes, hand grenades), mines, ammunition stores; terrifying sights (cadavers, conflagrations, etc.); imminence of danger; death of comrades and injuries (wounds, contusions, sometimes concussion in the correct sense of the word), for the most part not of a serious nature.

These different factors, whether acting alone or in combination, show no efficiency except as they light upon a soil prepared in advance to undergo their action, a predisposed soil. The predisposition results most often from a constitutional defect consisting in emotional instability. "The individuals destined for shell-shock are, before all, the emotionally unstable in whom the constitutional peculiarity has mostly manifested itself in their lives at occasions of painful emotion, and who react to events of the war as they have reacted to events of ordinary life, but in a manner infinitely more intense, because the excitants are infinitely more powerful."<sup>2</sup>

This constitutional instability may be accentuated, and even its place at times taken, by all external causes of debilitation of the nervous system: infectious diseases (typhoid fever or simple diarrhea), exhaustion, sometimes a previous explosion or emotional shock. It seems, in the last case, as though there might be a summation of emotional effects. I have cited in collaboration with Gilbert Ballet, the case of the Zouave who, thrown once by the explosion of a shell, escaped with a little dizziness and headache, but remained nervous and irritable, and three months later, after a second explosion, presented a typical emotional psychoneurosis."

Before passing on to a consideration of the *symptomatology* of these conditions, we may pause a moment to note what MacCurdy has said of the influence of fatigue in the etiology of the war neuroses.

"The first sign of an approaching neurosis is fatigue. The word sign, rather than symptom, is used because fatigue as such is a condition which is completely removed by rest, and rest of quite brief

<sup>2</sup> Gilbert Ballet and J. Rogues de Fursac, Les psychoses commotionnelles, psychoses par commotion nerveuse et choc emotif. Paris medical, Vol. 6, No. 7, Jan. 1, 1916.

duration. For the neurosis, fatigue is of importance, as it is the almost universal occasion of the dissatisfaction with his work which leads to a breaking down of the soldier's adaptation and the development of more permanent symptoms. The conditions producing fatigue are both physical and mental. Those on the physical side are the obvious ones of long hours of duty, combined often with irregularity of meals, shortness of water, exposure to extremes of temperature, constant wetting, etc. Although these factors need no detailed consideration on account of their obviousness, their importance in producing fatigue cannot be too strongly emphasized. Important as they are, however, they are probably of less influence in the production of neurotic fatigue than are the purely mental influences. The most common and important of these is the strain of continuing in a dull routine that demands a constant alertness, a speediness of decision, complete self-confidence and a spontaneous eagerness. And this mental attitude must be maintained hours, even days, on end, without sleep, often without the distraction of food, and in the face of constant danger. Other, more personal, factors contribute to the development of fatigue. A man, for instance, may be placed under the authority of someone who is antagonistic to him and makes everything as difficult as possible. This naturally leads to distrust, and once a man's confidence in his superiors is lost it is soon impossible for him to disregard the strain under which he suffers. Many men, too, have peculiarities that make them susceptible to particular discomforts. Such things as the presence of vermin, and the frequency of bad odors, particularly where there are many unburied bodies, are factors of no mean importance in slowly disheartening the soldier. In fact, one can safely say that in view of the many external physical difficulties, a soldier can be kept in the best mental condition only when he is not irritated by things which affect his special sensibilities, and most important, when he feels socially comfortable with his mates. Not infrequently the death of a close friend or comrade may be the signal for the stress of warfare to make its effects known. Civilian life does not favor the development of fatigue to anything like the same extent as does the stress of war.<sup>3</sup>

Relative to the discussion of fatigue there are a number of different factors which are greatly stressed by the literary writers of the war but are too lightly passed over by the devotees of science. The titanic character of the explosive forces has never before been as great and not enough attention has been paid to the shock effects

<sup>3</sup> War Neuroses. John T. MacCurdy, Lieut. M. R. C., U. S. A. *Psychiatric Bulletin*, July, 1917.

of the enormous vacua that these heavy explosives have induced and the results that have followed because of the changes in the atmospheric tensions in their effects upon the dissolved gases of the tissues and in the blood. While from one point of view it may be maintained, and with a certain amount of justice, that this type of modification of function should not be here considered because of the great tendency that there may be under such circumstances to develop definite tissue changes and hence these cases are not truly emotional; in a deeper and more intrinsic sense the nervous system, and the entire body for that matter, should not be parcelled out into this tissue and that tissue, and a differentiation of functional loss posited on the ground of such separation. It cannot be too definitely stated that there are no dividing lines in bodily functioning and what affects one part of the body is bound to affect all. Hence to attempt too rigidly to confine the discussion to *no* organic, *some* organic and *all* organic is not in conformity with the facts and ends in futile disagreement. Behind every functional change must reside some change in the molecular or in the structuralized form of the tissues. Running through every organic injury there still may be found the psychic element, and in the long run the most organic of lesions will have to have its proper psychotherapy continuously applied if ultimate recovery is to result. This is being more and more emphasized in all of the recent formulations and should be stressed at this point before the subject of etiology is disposed of.

From the very beginning of the war the amounts of explosives in the individual charges has been mounting rapidly. A study of the figures here but briefly indicated shows this. Thus the shell of the German 77, weighing 7.175 kilos, at the beginning of the war contained about 0.165 k. of tolite, and the French 75 contained 0.825 k. of melanite. The German cannon of 130 and 150 utilized in the early battles shooting 14 to 15 kilometers with shells of 40 to 50 kilos contained 3.270 to 4 k. of explosives. The heavy 150 commonly employed used a charge of approximately 4.8 k. of pieric acid. As for the mortars, which were largely utilized for the destruction of battlements and fortifications of all kinds, the German 210 and 280 carried shells with at least 16 to 17 k. of explosive. The Austrian mortars of 305 carried projectiles weighing 417 kilos, contained 40 kilos of explosives and later 60 kilos. The mammoth mortar of 420 carried a charge of about 110 kilos of explosive. In the beginnings of the combat the larger number of German pieces with their larger charges were opposed by much smaller batteries on the part of the French with smaller charges and the result was

that the French suffered much more than their opponents from shock accidents. Indeed in the earlier German literature this was used as an argument that the French were a neurotic and psychopathic race and were degenerating. Such types of reasoning were a natural byproduct of the earlier stages of the campaign and the real reasons were overlooked. The shocks were greater by reason of the differences in the amount of explosives used.

As the number of batteries and the field pieces augmented, however, the amounts of explosives ran up and the opposing forces more adequately balanced, the percentages more closely approached each other. By 1915 the 500-kilo shells with 150 kilos of explosive became commonplaces. But apparently these more heavy engines of destruction were not responsible for as much damage to the average soldier's nervous system as the so-called artillery of the trenches. The minenwerfers, torpedoes, bombs, etc., were responsible for the greater number of shock cases. Fifty to 140 kilos of cheddite are utilized in some of the trench torpedoes, and according to the testimony of Leri and others were responsible for more than half of the severe commotion and contusion cases. In considering the vacuum capacity that these large charges are capable of bringing about it should be recalled that on explosion the liberated gas for fulminate of mercury, for instance, occupies 27,000 times its volume of original substance. For nitroglycerine 9,000 volumes are to be reckoned. This immense volume of gas develops pressures which readily reach the surface pressures of at least 70,000 pounds to the square centimeter. Thus the gas pressures alone can be considered almost as if it were a solid projectile, as such gas blasts are truly "breaking," destroying even solid rocks. It is no wonder then that even at great distances the effects upon the nervous tissues should be so disastrous. And furthermore it is no wonder that the organic element in these shock cases should receive very serious consideration. As neurologists know, this contention has been that of Mott, from the very beginning and it should always be held in mind even if the particular patient under consideration does not present the more evident signs of concussion. Whereas a rough general grouping such as Leri's into the *commotionné*, *contusionné* and *émotionné* has great practical advantages, it should be borne in mind that nearly every patient will present a *mélange* of varying proportions of each of these separable concepts, and as already pointed out the clinical picture will vary from the trenches to the ambulance stations and to the base hospitals.

One of the most practical aspects in the study of these types of

cases caused by the production of vacua is the development of many curious conditions allied to the type of case seen in the workers under gas pressure—the so-called caisson disease types. These have been very frequent and their study is especially illuminating. In a large number of the returning war neurosis patients extended enquiry and very minute and careful examinations will reveal this important etiological factor, often hid in a host of other factors. In the explosions of mines, in which sometimes as much as 40,000 kilos of explosive have been discharged at once, the severest type of “caisson” cases have been observed. They also are more apt to be found when a shell explodes within a more or less solid dugout or cellar.

Fortunately, however, for the mass of soldiers the laws governing the distribution of gas pressures from explosives are such that in spite of the terrific nature of these explosions very simple protection may be sufficient to enable the trained soldier to avoid the consequences. Thus it is in the open plain and at short distances from the exploding shells that the commotions of the nervous tissues take place which in larger or smaller degree determine the shock consequences. They are rarely found in the trenches unless the “obus” falls directly in the trench and they are exceptionally found in the dugouts. It is largely by reason of these facts that commotion from these enormous explosive charges is comparatively rare, and according to the reports from many sources much rarer than the largest of all the classes, the more truly emotioné, with which they are largely confounded and which as has been pointed out rightly confounded, for it were infinitely better to consider every patient as sick and treat him accordingly than to assume the very superficial attitude that they are all pretenders, a tendency all too common among the inexperienced.

Before closing this section on the etiology of the war neuroses one other feature requires brief mention. Those already discussed by no means exhaust the subject, for to do this, as has been said, would require many volumes, but a word should be said about the constitutional background of the potential and actual war neurotic. We shall not attempt any exhaustive analysis of the many facts which the pre-war studies have thrown upon the many heredity factors which summarized make up the constitutional background. We desire only to indicate the trend of certain recent studies which will undoubtedly be of great service in the future in aiding the recognition of the future neurotic. The rapid and accurate methods of neurological case examination have been of great service as well, but for the ascertaining of a number of valuable facts relative to the

constitutional background methods of rapid case examination have yet to be evolved. The lengthy and complicated personality tests are not applicable save for special material and for certain definite types of problems, the study of officers, for example. There still remains a problem of immense importance. Will it be possible by objective methods of case examination to determine poor nervous and mental integration? This is a question which cannot yet be definitely answered. There are indications, however, that a proper valuation of the many growth factors, which are to be learned from a careful study of the vegetative functions of the nervous system and especially of its endocrinous functions, will reveal many criteria which will answer this question to advantage. A study of the endocrinous functions then will bring out many subtle growth factors which carry one directly into the field of the constitutional background much more rapidly than the study of hereditary data. For it has to be remembered that careful inquiries into the family histories of all peoples, healthy as well as sick, have shown that the preponderance of sick heredity for the mass of the neuroses and psychoses is but a trifle more than that for healthy individuals. We can obtain little light in this direction, in fact we get a lot of confusion. Direct examination of endocrinous anomalies however throw a lot of light on the most important functions of the nervous system, that of metabolic balance, which is a necessary prerequisite for healthy mental functioning. Special attention should be given to status lymphaticus primarily. In this field may be traced the successive steps which lead to a healthy or an unhealthy balance of growth factors. Faulty compensations here lead to maladjustments in other endocrinous gland activities and a group of anomalies in growth trends may be traced where in one or another instance the compensatory activities bring out defect states which are of paramount importance in estimating whether the individual is going to have the necessary material equipment to carry out the desired and imperative mental tasks. With a defective lymphatic evolution too much stress will fall now on one system now on another. The thyroid may break down under the S. O. S. call, or the adrenal system will need the accessory help of the pituitary. The minor maladjustments which have been trying to adjust up to the age of twenty leave their indubitable earmarks in bodily structure, and out of these minor signs of already achieved adjustment or of compensations in the making, may be read the signs of potential nervous disaster when the stress becomes more than the machine will bear. This feature cannot be stressed here at greater length but will be considered anew in the section on the symptomatology.



### Symptomatology

MacCurdy has divided the war neuroses into anxiety hysteria and conversion hysteria. There are of course many mixed and borderline cases which do not fit into either of these two large groups, but nevertheless this classification is useful in studying the clinical pictures.

In the anxiety group there are certain premonitory symptoms. These are a feeling of tenseness, a restless desire for action or distraction, irritability, difficulty in concentration, and a tendency to start at any sudden sound (without fear), the sound being usually that of exploding shells. This reaction of nervous starting is so common that it is universally known by the officers and men as "jumpiness." The nocturnal symptoms are even more distinctive. There is great difficulty in getting to sleep, with a long period of hypnagogic hallucinations. Whatever has been the dominating experience of the day appears in troublesome vision before the eyes of the soldier, who, although knowing that what he sees is not actually there, is still unable either to go to sleep or to awaken himself sufficiently to banish the visions. The only emotional reaction is a feeling of irritation with restlessness. Fatigue as such does not seem to produce fear. When sleep does come, it is often troubled by repeated dreams of the occupational type, where the soldier is trying to do whatever was his task during the day, is having constant difficulty and meeting with no success in accomplishment. The sleep, too, is frequently interrupted by the man suddenly awakening with a jump, although he is not conscious of this waking being the result of any incident in his previous dream. As a result, he gets many less hours sleep than he expected, and little benefit from the sleep he does achieve. He awakes in the morning more tired than when he lay down, feeling slow and unwilling to assume the duties to which he has to force himself.

When this situation has continued for some time and become cumulatively worse, fear develops and also horror of the sights around him. Both of these are signs that the war sublimation has failed. The soldier finds himself, when alone and not mentally occupied with his duty, thinking of the horrible sights he has seen. He dwells obsessively on the difficulties which surround him, on the frictions he may have with brother or superior officers, and cannot keep his mind away from the possibility of injury. At this stage any sudden strong emotional shock such as a nearby explosion of a shell or bomb, some ghastly sight or other trying experience, is sufficient to precipitate the neurosis.

A brief summary of the ordinary symptoms of such cases may be taken from de Fursac: There is first an acute state of either stupor or excitement, usually accompanied by hallucinations and delirium. To this stage belongs also the state of mental confusion and to this stage alone, for, in the majority of cases, when the mental storm has subsided, the patient ceases to be confused; he is simply depressed, or, in brief, a psychasthenic. This first period lasts only a few days. It often ends suddenly, leaving a period of total blank in the patient's memory. The succeeding phase is characterized by three fundamental mental alterations: psychic inhibition, hyperemotionalism, and abnormal activity of the imagination. Under inhibition may be classified psychic impotence, the various forms of amnesia, nervous and sensory anesthetics and hypesthesias, general muscular anesthesia, affections of movement and speech, and the functional paralyses of which mutism is a form. Under hyperemotionalism belong states of anxiety and worry, sometimes accompanied by paroxysms, together with all the organic disorders attendant upon violent feeling, such as tremor, respiratory vasomotor affections, vertigo and convulsions. To overactivity of the imagination may be attributed bad dreams, somnambulism, and episodic hallucinatory crises, the last comparatively rare. This overactivity of imagination is essentially centered upon the events of war. Bombardments, beating of drums, bayonet charges, the slain on the field, form the background of almost all the dreams and hallucinations. Hyperemotionalism and exaltation of the imagination give to the shock syndrome its distinctive character and differentiate it from ordinary psychasthenic states, with which it might be confused, were they compared on the basis of inhibitory characteristics.

This outline of symptomatology shows that *shell shock* is only emotional shock intensified and fixed. The study of these states of mind is simply a study in the pathology of the emotions, of such conditions as have been found before the war following railway accidents, mine explosions, earthquakes and all great catastrophes of such a type as to destroy the equilibrium of natures already unstable. Traumatic psychoneuroses resulting from injuries received in industrial accidents and those of civil life often present the same syndrome, sometimes in as perfect and dramatic a form as in the pathology of war.<sup>4</sup>

<sup>4</sup> Abstract of de Fursac's article by Mabel Webster Brown in Mental Hygiene's Collection on "Neuropsychiatry and the War."

## Current Literature

### I. VEGETATIVE NEUROLOGY

#### 1. VEGETATIVE NERVOUS SYSTEM.

**Head, H., and Riddoch, G.** THE AUTOMATIC BLADDER, MASS-REFLEX, AND OTHER PROBLEMS. [Brain, 40, 1917.]

The British Medical Journal commenting editorially says that the advance of medicine depends partly on clinical experience and largely on special investigations carried out in laboratories, both in direct relation to disease and on other lines. It is now generally recognized that pure physiological research undertaken to increase scientific knowledge, though not at once obviously applicable to the needs of medical practice, sooner or later makes the clinician its debtor. On the other hand, the work of the active physician and surgeon, though often of help in elucidating the problems of physiology, is rarely of such an exhaustive and far-reaching character as that of Dr. H. Head and Dr. G. Riddoch recorded in the current number of *Brain*. Clinical research of this kind demands a special training and a devotion of time and energy that are only exceptionally available; it is therefore of peculiar value, and to some extent may redress the balance of debt to our physiological colleagues.

Utilizing the unexampled opportunities afforded by the casualties of the war for an intensive study of the phenomena of gross lesions of the spinal cord, Dr. H. Head and, under his inspiration, Dr. Riddoch, the medical officer in charge of the Empire Hospital, Vincent Square, have carried further Professor Sherrington's work on the decerebrate animal, particularly as regards the problems of postural coördination. While the object of the authors is to consider the physiological principles underlying the clinical manifestations, the practical outcome of their careful observations on these paraplegic patients is very important, especially as regards the vesical condition which has such an essential bearing on prognosis. After a severe spinal injury complete retention may, if a catheter is not passed, be succeeded by cystitis and death before any signs of the complete act of automatic micturition can occur; if a catheter is passed, so that overdistension and infection of the bladder are prevented, retention usually passes off, and eventually the bladder automatically empties itself. The bad effect of overdistension of the bladder must be borne in mind in washing out, for considerable pressure, such as may be obtained by raising the vessel to a height of several feet above the bed, easily overcomes the contractile power of the

bladder and so only adds to its contents. The "automatic bladder" may in favorable circumstances—namely, the absence of cystitis, toxemia, and fever—become established after a complete transection of the cord and also after complete destruction of the cauda equina; but there is the essential difference that when the automatic bladder exists independently of the spinal cord it is impossible to influence it reflexly by stimulation. The subject of the innervation of the bladder and urethra is reviewed by Dr. Fearnside as an appropriate introduction to these observations.

When the control of a segment of the spinal cord is removed by a complete division, the discriminating and specific character of a normal reflex, such as the scratch reflex, is lost, and after the shock has passed off the lower part of the cord gradually regains its reflex activity, which is now uncontrolled; as a result stimulation leads to widespread discharge of motor energy overflowing into visceral channels; thus, stimulation of any part of the skin of one lower extremity, or even of the abdomen, may lead to characteristic flexor spasm extending to both sides, evacuation of the bladder and rectum, and excessive sweating. In this reflex the bladder is emptied when it contains less than half the amount that the automatic bladder usually discharges; and this "facilitation" of the automatic bladder is a good index of the widespread effect of a stimulus, and is seen only when the postural reflexes are absent, as in complete division of the cord. The excessive sweating—a remarkable feature of these cases—is due to activity of the nervous system below the lesion in the cord, and can be excited by almost any stimulus sending afferent impulses into the cord below the lesion, such as scratching the skin, washing out the bladder, or an enema. The massive or "mass-reflex" is part of the primitive protective reflex to pain, and not part of the normal postural reflex, whereas in cases of incomplete division of the cord the lumbar centers may still be inhibited by the pre-spinal centers and the postural reflexes persist.

In his complementary article on the reflex functions of the completely divided spinal cord in man (based on eight cases proved at operation) compared with those associated with less severe lesions, Dr. Riddach shows that the clinical picture hitherto given as characteristic of a complete division of the cord is imperfect, and describes three stages: (1) of muscular flaccidity, corresponding with the period of deep depression from "spinal shock," and lasting from one to three weeks, with absence of superficial and tendon reflexes, toneless muscles, and retention of urine and feces; (2) of reflex activity, with the mass-reflex; and (3) of gradual failure of the reflex functions of the isolated spinal cord due to toxic febrile complications; the mass-reflex is no longer obtained, and the reflexes disappear, the extensor tendon jerks going first. There are no manifestations absolutely diagnostic of anatomical division of the cord, but some cases of severe damage to the cord with abolition of motion and sensation and with automatic action of the

bladder and rectum show certain manifestations not present in cases with proved anatomical division of the cord. Movements of the flexor type were the only primary motor reactions observed in complete transection, whereas in the contrasted group of cases the involuntary movements may simulate progression or be entirely extensor. The clinical picture in complete division of the cord resembles that described by Babinski and Walshe as "paraplegia in flexion," and is comparable with that of the "spinal" animal, while their picture of "paraplegia in extension" is like that in the less severe spinal injuries, and comparable to that of the decerebrate animal.

**Riddoch, George.** HYPOTONIA AND TROPHIC CHANGES. [Section of Neurology of the Royal Society of Medicine, January 24. B. M. J.]

Captain George Riddoch contributed a paper on muscular hypotonia and changes in nutrition associated with lesions of the posterior columns of the spinal cord and the posterior roots. Defining reflex muscular tone as postural contraction (Sherrington), he pointed out that tonus was found in those muscles which maintained the animal erect; it depended upon a reflex system excited by afferent impulses arising during tension and stress from muscles and tendons. The controlling centers of this system were situated in the mid-brain, pons and medulla. The activities of this system were adjusted through impulses from the labyrinth and by the cerebellum. The peripheral fibers ran in the deep muscular nerves. Hughlings Jackson taught that rigidity of the affected limbs in cases of hemiplegia was due to unantagonized cerebellar influences. The activities of this reflex mechanism might be entirely unconscious. Head and Thompson stated and emphasized that "sensation may never be evoked until some disturbance of equilibrium produces impulses which, passing up sensory paths, reach the highest centers concerned with sensation." Their findings suggested the close association through collaterals of the posterior columns and the afferent cerebellar tracts. Whenever hypotonia followed lesions of the posterior columns, it was always associated with defective appreciation of space: but in hypotonia resulting from lesions of the posterior roots, at a level where all sensory impulses were still in their primary grouping, all aspects of sensation were affected, and the area of sensory loss was determined by the number of the roots involved. Captain Riddoch quoted instances of cases to show that by an investigation of the condition of sensation in the affected parts the level and the extent of the lesion giving rise to the hypotonia could usually be determined. He described some of the trophic and vasomotor changes frequently observed in the affected hands after injury to the posterior columns of the spinal cord in the region of the cervical enlargement; in character these changes closely resembled the associated trophic and vasomotor changes found in cases of causalgia of the median nerve. From the sensory picture of the hands

he adduced that trophic and vasomotor changes of this type were due to damage to the posterior roots involving the "visceral" afferent sympathetic fibers belonging to the sympathetic nervous supply of the hand, and not to any injury of the spinal cord. The afferent fibers of the sympathetic involuntary nervous system probably had more or less the same regional distribution as the efferent fibers, and passed into the spinal cord by the segmentally corresponding posterior nerve roots. Such facts might explain the minimal nutritional and vasomotor changes in the legs and feet after injury to the lower lumbar and sacral posterior nerve roots, where hypotonia was present and sensation was definitely affected but not completely abolished.

**Retif, Edouard.** PHYSIOLOGICAL RESEARCH ON THE SEMI-LUNAR GANGLIA. [Compt. Rend. Soc. de Biol., 1918, LXXXI, p. 82.]

The chief results of the writer's experiments on the semi-lunar ganglia of rabbits and dogs are as follows: (1) Removal of the left semi-lunar ganglion of rabbits gives merely temporary diarrhea and slight wasting; (2) bilateral removal of the semi-lunar ganglion, or removal of the right ganglion, has always given symptoms followed by death in hypothermia; (3) this post-operative terminal hypothermia is connected with hypoglycemia; (4) extirpation of the semi-lunar ganglia gives a great loss of body weight; (5) all of the operated animals have had diarrhea, usually intermittent, and sometimes appearing but slowly. The presence of this diarrhea and the constant great wasting leads Retif to think that solarectomized animals are in a state of dyshydration.

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**Berti & Roncato.** GLYCOGENIC FUNCTION AND THE VEGETATIVE NERVOUS SYSTEM. [Gazzetta degli Ospedali delle Cliniche, May 5, 1918.]

Investigations undertaken at various times and places have concurred in establishing the nervous regulation of the glycogen function of the liver through separate fibers belonging to the two divisions of the vegetative nervous system. These prove to be the fibers of the sympathetic which exert the secretory influence and those of the cranio-sacral [autonomic] division, that is in this instance of the vagus, which inhibit this action. Berti and Roncato devote several columns to a discussion of these experiments and their mutual confirmation of results. The school of Von Noorden base certain conclusions in regard to hepatic glycogenesis upon Langley's hypotheses supported both by clinical and pharmacological experience. They believe that this function is promoted by the sympathetic and inhibited by the vagus. They find that adrenalin, which excites the organs supplied by the sympathetic fibers, produces hyperglycemia and glycosuria, irrespective of the diminution of the consumption of glycogen and that this glycosuria can be arrested by pilocarpine, which is stimulating to the organs supplied by the autonomic system, here the vagus. Moreover, in some cases, the uncertainty

being apparently dependent on individual variation in tone, sympathetic or autonomic glycosuria can be caused by the administration of atropine, which acts to paralyze the organs supplied by the vagus. Researches definitely applicable to the glycogenic output of the liver have been made first by Vasoin and later confirmed by Farini, and again, with possible source of error removed, by Berti and Roncato. These experiments were made upon frogs in which in one group the vagus was cut, in the other it remained normal. At hibernating temperature in the frogs with cut vagus there was no evidence of change in the amount of glycogen retained in the liver or in the weight of the liver after several days' observation. In those frogs, however, which were roused from their dormant condition and kept in a higher temperature for twenty-four or forty-eight hours—both periods of time were tried—there was a marked difference. In those with severed vagus the diminution in the amount of hepatic glycogen was much greater than in the normal frogs. Also the weight of the liver in the vagotomized frogs diminished in far greater proportion than in the normal ones. These experiments served to establish the theories of the inhibitory action of the vagus upon this function of the liver. The vagus inhibited the transformation of hepatic glucose, which was promoted by increase of temperature. Evidently it contains glycoinhibitory fibers.

**Ramond, F.** DYSPEPSIA SYNDROMES. [Presse Medicale, June 20, 1918.]

In this article the authors would compress the vast agglomeration of dyspepsias into about four syndromes. He speaks of vasomotor, cyclic, inverse and combined types. In the vasomotor type, eating especially at night, may be followed immediately by congestion of the face, cold feet and hands, sometimes headache, dizziness, with or without tinnitus, tachycardia, lassitude, dilated pupils, etc., all vasomotor disturbances of the vegetative nervous system functioning. The treatment should be addressed to that branch of the vegetative reflex are mostly involved. Belladonna is the most efficient, with hydrotherapy and hygiene. The cyclic type, includes a vasomotor phase but it follows the meal immediately, there is usually an interval of fifteen minutes or more. After the vasomotor phase, a few minutes or more, and an interval of one or several hours, pain develops. It may be like a colic, and may radiate. This pain is probably of inflammatory origin. The third, the inverse type, in which pain comes on at once after the meal or after the first few mouthfuls, with possibly nausea and vomiting for a few minutes or half an hour and then these sensations subside, disappearing in the course of fifteen minutes, leaving vasomotor symptoms. The epigastric and xiphoid points are tender and also two points on the left side, at the junction of the cartilages of the eighth and tenth ribs and at point on the outer margin of the rectus two finger-breadths above the transverse umbilicus line. The congestion or gastritis in this type is in the upper portion of the stomach, while in the preceding type it is in the

lower portion. The disturbances in this inverse type seem to be mainly of toxic origin, from abuse of alcohol, from gas poisoning. A fourth type is a combination of these two. The abundant psychogenic features in many dyspepsias is apparently a terra incognita to this clinician and citiates the entire article.

**Mouriquand, G., Bonchut, L.** WAR DYSPEPSIA. [*Presse Méd.*, 26, 1918, No. 28.]

These authors analyze 200 dyspepsias occurring in soldiers. Of these, 110 were flatulent, while in the others pain or vomiting predominated. All the patients were young and robust. The majority were from rural districts, and the many exciting factors, plus homesickness, had been factors in their digestive disturbances. There were few city men among them. The emotional nervous element was the predominant note. The roentgen findings were normal as also the chemistry of the stomach. They are true gastric nemoses and military surgeons should get wise to their possibility; else treated as organic disorders, they become hospitalized.

**Raymond, F., Carrie, A., and Petit, A.** VEGETATIVE NERVE DISTURBANCES AND DYSPEPTIC STATES. [*Bulletins et mémoires de la Société médicale des hopitaux de Paris*, January 24, 1918.]

These collaborators have described a vegetative nerve syndrome characterized by vasoconstriction in the extremities, causing more or less cyanosis and coldness of the hands and feet; facial vasodilatation with flushes and redness of the skin; often tinnitus, flashes of light, dizziness, and a sensation of intracranial throbbing; exaggerated sweating, especially in the extremities; attacks of tachycardia and instability of the pulse; dyspneic sensations without increased respiratory rate but with deep inspirations followed by prolonged sighs; fibrillary tremor of the fingers, occasionally with tingling or numbness, and a high degree of susceptibility to emotional reactions. Sympathetic dyspeptic symptoms may either be superadded to the typical sympathetic syndrome or occur secondarily in true dyspeptics. The characteristic sympathetic dyspeptic symptom is a painful sensation of fullness and gastric distention, closely following a meal or beginning even during the meal, and lasting fifteen to thirty minutes or at most an hour. Generally no actual distention can be detected by inspection palpation, or measurement. Usually there is marked temporary sensitiveness of the epigastrium, and frequently a general lassitude persisting throughout the period of gastric digestion. In the secondary cases the underlying gastric disorder may be of almost any type: hyper or hypo conditions, atony with ptosis, different forms of gastric ulcer, etc. The typical immediate postprandial discomfort, together with some of the other sympathetic manifestations, are likewise witnessed in these cases. Between the two groups referred to occur a number of intermediate cases, in some of which chemical ex-



aminations and radioscopy are alike negative in spite of pronounced burning or cramplike, inconstant, and nonperiodic pain. This condition may be likened to a causalgia. The site of the irritation inducing sympathetic symptoms may reside either in the stomach itself; in a local disturbance in any other organ in the sympathetic distribution; or, the cause of the irritation may be general—an infection or intoxication, or a disturbance of the ductless glands, in particular the thyroid, genital glands, and adrenals.

**Udaondo, C. B.** GASTRIC ULCER AND POLYNEURITIS. [*Prensa Med. Argent.*, Vol. 4, 1918, April 20.]

A man of 45 developed polyneuritis at the same time that he had an extensive acute gastric ulcer. The neuritic pains seemed to grow worse or better following the course of the ulcer. It does not appear whether the ulcer caused the polyneuritis or *vica versa* and least of all that they both might have had a common source.

**Mendel, L. B., Osborne, T. B.** THE RÔLE OF SOME INORGANIC ELEMENTS IN NUTRITION. [*J. Biol. Chem.*, 33, III, 1918.]

The authors in one of the first of a series of rational attitudes towards the problems of metabolism have begun the analysis of what is imperative; that is what needs have sprung up in man's energy system whereby he must have certain stabile conditions in his environment in order that function may proceed. By feeding rats on rations in which individual ions have as far as possible excluded, but which are otherwise adequate for growth and nutrition, it has been demonstrated that Ca and P are needed in considerable amounts. Growth for about a year at a nearly normal rate was accomplished upon a ration containing only insignification quantities of Mg, Na, K, and Cl. Where both Na and K were present in the above small amounts, no growth occurred.

**Babonneix, L., and David, H.** A CONTRIBUTION TO THE CLINICAL STUDY OF MIGRAINE. [*Journ. de Med. e. d. Chirurg. Pratiques*, 1918, LXXXIX, p. 174.]

The writers claim that meningeal reactions play a part in the symptomatology of ordinary migraine and also the ophthalmic variety: there is in migraine a hypertension of the cerebrospinal fluid: "this explains the benefit which lumbar puncture gives in some cases (J. A. Sicard)." The writers draw special attention to the aggravation of the pain of migraine by coughing or sneezing, either spontaneous or volitional. They think that at each shock of a cough or sneeze the cerebrospinal fluid, in a state of momentary hypertension, disturbs the sensory trigeminal root, and so provokes a pain which is propagated to the meningeal filaments of that nerve. They regard the pain of migraine as due, not merely to a neuralgia, but to a true radiculalgia of the trigeminal nerve. And this radiculalgia is itself dependent on hyper-

tension of the cerebrospinal fluid, which is itself sometimes relieved almost instantaneously by lumbar puncture.

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## 2. ENDOCRINOPATHIES.

**Marine, D., and Kimball, O. P.** THYROID HYPERPLASIA AND IODIN.

[Editorial, J. A. M. A., March 23, 1918.]

In view of the widespread distribution of simple goiter in the United States as well as in those countries which have been the classic localities of thyroid enlargement in considerable portions of the population, it is rather surprising that so little attention has been paid to the subject. The hopeful aspect of the goiter problem lies in the fact that the malady is almost always easily avertible. The magnitude of the incidence of thyroid enlargement in man is indicated by the suggestive investigations which Marine and Kimball of Western Reserve University have conducted in the interest of the Committee on Therapeutic Research of the Council on Pharmacy and Chemistry of the American Medical Association. In a complete census of the condition of the thyroid gland in girls from the fifth to the twelfth grades of the school population of a large community at the southern edge of the Great Lakes goiter district, they found that 2,184, or 56 per cent., had enlarged thyroids, 13 per cent. having well-defined persistent thyroglossal stalks. These startling facts correspond with what might have been anticipated only by consideration of goiter statistics from some of the most conspicuous goiter regions of Europe.

To meet this situation a systematic scheme of administration of iodine in some form has been proposed. Its efficacy is admitted; and the widely adopted plans of school inspection by duly appointed medical experts seem to furnish an almost ideal opportunity for observing the results of a wholesale attempt to counteract the tendency to goiter that prevails in many localities. Wherever the thyroid hyperplasias have been encountered and carefully investigated, they have yielded to the iodine therapy. Marine and Kimball state that from the practical standpoint, the first instance of preventing goiter on a large scale was accidental and in connection with the sheep raising industry of Michigan. Prior to the discovery of salt deposits around the Great Lakes, the future of the industry seemed hopeless; but with the development of the salt industry and its use by the sheep growers, goiter rapidly decreased. The explanation is furnished by Marine. The salt contains appreciable quantities of both bromine and iodine, and in places these elements are extracted commercially. The second instance of goiter prevention on a large scale was in brook trout, and the disease was averted in the hatcheries by the use of small amounts of tincture of iodine added to the water. Similar possibilities have been suggested to prevent the fetal myxedema of pigs and the hairless pig malady that has been definitely associated with a hyperplasia of the thyroid gland of this species. We have already directed attention to the widespread ex-

perience, in the northwestern part of the United States, of the animal growers in obtaining young that are born dead and hairless, or, if alive when born hairless, die in a short time.

There seems little doubt that the immediate cause of these thyroid disturbances is associated with a deficit of iodine in the gland itself. The avidity of this tissue for iodine is now well known, analyses of the hyperplastic glands confirm the deficit of the element, and the remedial response to iodine medication is an added indication of the correctness of the view just stated. The first impulse is to assume, in the light of what has been found, that a deficiency of essential iodine in the food supply is responsible for the pathologic condition so often observed in the thyroid of both man and animals. The extensive investigations now undertaken from the standpoint of animal nutrition have an immediate interest for human pathologic physiology. It has actually been shown that feeds from all parts of the country tend to be extremely low in their content of iodine; and there are no obvious distinctions that can be ascribed to different localities. Hart and Steenbock have accordingly formulated the query whether the primary cause of thyroid hyperplasia, such as they have observed in swine, may not be associated with a failure to absorb iodine from the digestive tract or to a faulty metabolism of the gland rather than to an extreme shortage of the element. They have observed that the same feeds which produce hairless and dead pigs can be so combined as to produce normal young. It thus seems that if certain unknown conditions are favorable, an animal may obtain from natural feeds the iodine required for both her own and the fetal thyroids. If unknown unfavorable conditions prevail, the animal may then obtain barely enough for her own thyroid activity and not enough for fetal thyroid development. In other words, a ration that is near the border line of deficiency in iodine and, as Hart and Steenbock express it, slightly out of balance in some other respect, may affect some individuals more than others. This seems to be particularly true during the period of most rapid growth. In recognizing a corrective factor in iodine we need not overlook the possibility of deficient functions which are a secondary yet important consideration in the complete solution of the difficulty. None of the more recent experimental evidence, however, gives support to the hypothesis that the enlarged thyroid is the result of a specific infection.

**Ramond, F., Francois, A.** ADDISON'S DISEASE AND EXOPHTHALMIC GOITER. [Bull. de l. Soc. Med. d. Hosp., Nov. 16, 1917.]

The authors believe that there is a thyroid reaction by which its function is increased to supply the insufficiency of the suprarenal glands in Addison's disease. Such a reaction was obtained in four out of twenty-six cases. In one case the thyroid enlarged about six months after the onset of Addison's disease, with tachycardia, tremor and other symptoms of exophthalmic goiter. As these developed the symptoms

of Addison's disease diminished. The authors have followed these observations with an organotherapy based upon these phenomena and have obtained marked improvement in three cases. Their procedure is to give the patients with Addison's disease 0.5 gm. of pulverized suprarenal tissue and 0.01 gm. of thyroid powder after six days fasting. The suprarenal tissue is given for ten days more while the thyroid is dropped, then the two are given again combined for ten days, and thus the therapy continued. Each dose was given in the morning.

**Kjölstad, S.** GOITER IN NORWAY. [Norsk Mag. f. Laege., March, 1918.]

Kjölstad reports from the Telemarken district of Norway the extreme prevalence of goiter even among the school children. These goiters are mostly of the atoxic type and respond readily to iodine treatment. Children seem to bear this very well, but with adults he has had to guard against thyrotoxic development, while with one girl of fifteen the iodine seemed to be responsible for the change of her simple goiter to an exophthalmic one. He believes that the treatment must be much prolonged, for vigorous treatment is dangerous. His method is to use 0.10 gm. potassium iodide every other day for two weeks, then to suspend this for three weeks, resume for two weeks and so on. This he does for colloidal goiters, while for simply parenchymatous goiters he uses the Kocher method of incision with iodine-potassium iodide salve, 1 to 3 gm. daily for two weeks with suspension for three weeks. Tincture he believes injures the skin and roentgen treatment may injure the still intact portions of the gland. Sodium phosphate, a tablespoonful of a 5 per cent. solution four times a day in milk proves useful in exophthalmic goiter or with other symptoms of excessive functioning. This is on Kocher's principle of the antagonism of iodine and phosphorus. Surgical measures should at last be resorted to before parenchymatous degeneration is allowed to appear.

**Friedman, G. A.** PARATHYROIDECTOMY AND THE GASTROINTESTINAL MUCOSA. [Journal of Medical Research, March, 1918.]

Friedman was able to produce gastric or duodenal lesions after parathyroidectomy in eleven out of fourteen dogs, and in two dogs appendicitis lesions were present, in one associated with a duodenal ulcer, and in the other with a gastric ulcer. Similar results were obtained with rabbits, so that Friedman believes the initial lesion of peptic ulcer and appendicitis may be produced by a disturbance in the thyroid secretion. These lesions did not show a tendency to heal because of the continued thyroid disturbance. As the degree of thyroid insufficiency in man is less than that produced experimentally in animals, there is the likelihood that the anomalous constitution created by lack of thyroid secretion may be corrected, but if this does not happen, through the irritation of food and the effect of excessive secretion of

hydrochloric acid, the acute ulcers may become chronic. It therefore appears that the thyroid, and perhaps the parathyroids and adrenals, may be responsible for the association of peptic ulcer and appendicitis.

**Henderson, Pearl S.** GUANIDINE OF MUSCLE IN TETANIA PARATHYREOPRIVA. [*J. Physiol.*, 1918, 52, p. 1-5.]

Henderson here would tend to show that after parathyroidectomy, the free creatine increases in muscle to a corresponding degree. The total guanidine, however, falls far in excess of this, which indicates either a loss from the muscles, or their failure to take up guanidine formed elsewhere; in either case this is correlated with the increase in blood and urine noted by Burns and Sharpe.—[Phys. abst.].

**Aschner, Bernhard.** THE METABOLIC AND VISCERAL CENTER IN THE INTER-BRAIN: ITS RELATION TO INTERNAL SECRETION (PITUITARY, PINEAL) AND TO DIABETES INSIPIDUS. [*Berl. klin. Wochschr.*, 1916, LIII, p. 772.]

Conclusions: (1) It has not yet been satisfactorily proved that the blood-pressure raising action of pituitrin depends on the pars intermedia and not on the pars nervosa. (2) The same is true of its diuretic action. (3) It is certain that the pars intermedia has nothing to do with fat metabolism, albumen metabolism, respiratory metabolism, inhibition of growth, and genital disturbances; these effects belong especially to the action of the anterior lobe of the pituitary. (4) The indubitable experimental diuretic action of pituitrin (posterior lobe with the addition of an insignificantly small action of the pars intermedia) is related to the observations of Hoppe-Seyler and others that diabetes insipidus and polyuria are inhibited, and not produced by pituitrin. (5) But there are certain new factors that need consideration, namely, the "vegetative center of the inter-brain" postulated by Aschner. (6) In favor of the existence of such a vegetative center there is a series of earlier established facts, namely, a temperature center in the corpus striatum, Eckhardt's center for water-regulation in the corpora mamillaria. Secondly, there is the hypothalamus diabetic-puncture described by Aschner, and also the following effects obtained by mechanical or electrical stimulation of the tuber cinereum, namely, manifestation of severe pain, slowing of pulse up to stoppage of heart, increase of blood pressure, painful respiration, contractions of the pregnant uterus, bladder, intestine, etc. Thirdly, the sympathetic center in the tuber cinereum (discovered simultaneously and independently by Karplus and Kreidl and by Aschner), stimulation of which in the cat gives dilatation of pupils and secretion of sweat. (7) This inter-brain center for growth, metabolism, regulation of temperature, and genital development, is concerned not merely with diabetes insipidus, but also with all vegetative disturbances, possibly also with psychical disturbances (migraine) due to cerebral diseases and affections of the pituitary and the pineal bodies.

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## II. SENSORI-MOTOR NEUROLOGY

### 3. SPINAL CORD.

**Chartres.** MALARIAL PARAPLEGIA. [Bull. Soc. Med. Chir. Ndoch., Vol. 7, No. 3, March, p. 102.]

This case report of a mild myelitic syndrome, without involvement of bladder nor rectum, complete paraplegia, due to frequent acute malarial infections. Fifteen days' treatment by quinine given by injection effected a cure.

**Mussen, Aubrey.** THE FINER HISTOLOGICAL CHANGES IN THE TRAUMATIC DEGENERATIONS OF THE SPINAL CORD, FOLLOWING BULLET WOUNDS OF THE CORD SUBSTANCE, OR SHOCK TO THE VERTEBRAL COLUMN. [Review of Neurology and Psychiatry, Vol. XIV, No. 10.]

A severe shock to the spinal column, without directly involving the cord, may produce profound disturbances in the spinal medulla. And when the cord itself is directly affected, these same relations bear an important part in transmitting to distant regions the effects of the concussion. Cases cited comprise bullet injuries of the brain, with secondary effects on the spinal cord; bullet wounds involving the cord directly; fracture of the laminae with injury to the cord substance; wounds involving the transverse process of a vertebra; and bullets embedded in the body of a vertebra without direct injury to the spinal medulla.

As the duration of the illnesses varied, the material investigated represented degenerations of 10 hours, 24 hours, 48 hours, 60 hours, 1 week, 11 days, 7 weeks, 2 months 4 months.

The methods employed were: Bielschowsky's silver impregnation; Mallory's frozen section method; Herxheimer's Scharlach R.; and Marchi counterstained by Mallory. These combined methods determined any changes in axis cylinders; alterations in myelin sheaths; presence of neuroglia cells and fibers, degenerations in the myelin. Earliest traces of fat degeneration, and their relations to nerve fibers, glia cells and blood vessels; and facilitated investigations of changes in the later stages of the degenerative process.

*Case I (10 hours).* Soldier was wounded by a hand grenade. One piece entered the right frontal lobe of the brain; there was no great hemorrhage, though sufficient to fill the region of the pons with clot. A second piece entered the neck, divided the right vagus, opened the jugular, and went on and bared the transverse process of the fifth or sixth cervical vertebra. It did not penetrate into the canal. He lived about ten hours. The post mortem showed that the cord was apparently uninjured.

Bielschowsky preparations from the cervical region show that the axis cylinders throughout the greater portion of the longitudinal section are normal. Their course across the whole field is straight; the fibers,

which are of an equal size throughout, show a slight waviness, but there were no sharp twists. In another region of the same section the axis cylinders are suddenly bent at regular intervals, but there is no swelling or breaking of the fiber.

Mallory sections show the twisting of the axis cylinder as well as a distinct globular swelling of the myelin sheath, which also presents in some fibers a granulated appearance. Some fibers show a distinct swelling of the axis cylinders at regular intervals. This is generally associated with fibrillation, and occasionally with partial rupture; no changes were observed in the neuroglia cells.

The Marchi method shows here and there, extended along some nerve fiber, a few small dark staining balls of myelin. From their small size and the fact that the Scharlach R. shows no fat reaction it is evident that they are the Elzholz bodies, symbolic of the normal metabolism of the central nervous system.

*Case II (24 hours).* This was only a portion of a cord. It showed a complete transverse division about the level of the first dorsal segment from a rifle bullet. Death occurred twenty-four hours after the injury. Sections stained by the Bielschowsky method show that the fibers are swollen, and in many instances broken. Many fibers are thrown into kinks and twists, which are sometimes so marked that complete loops are formed. The large majority of the fibers, though, in this section are normal.

*Case III (about 48 hours).* This patient arrived at the hospital moribund, and died without recovering consciousness. He had been wounded by a rifle bullet which fractured the first dorsal spine as well as the laminae on both sides. The body and pedicles were not injured. The notes state that death occurred between twenty-four and forty-eight hours.

At the post mortem, when the laminae were removed, the theca appeared to be quite normal. On cutting the cord there was an extensive hemorrhage in the central gray matter three segments from the lesion. The portion of the cord forwarded for examination included from the fifth cervical segment to the fourth dorsal segment.

Captain Stokes noted that he had seen three cords in which there was an extensive microscopic injury, though there had been no direct contact of the projectile with the cord. He mentioned that the remote effects of bullet injuries is not sufficiently recognized, which probably accounts for a great deal of the sepsis and delayed repair. This remark is based on his observations on the muscles, kidney, and liver, and he thinks that the three cases mentioned bear it out as regards the nervous system.

When the cord was examined at the laboratory, small scattered hemorrhages were seen throughout the white and gray matter. These involved the whole portion of cord obtained, and were most marked in the upper region.

Bielschowsky preparations show the bead-like swellings sometimes found along the nerve fibers; myelin sheath distended; axis cylinder bent and twisted.

Mallory sections show a very marked state of degeneration.

*Case IV (60 hours).* A portion of a spinal cord from a case wounded by a rifle shot. The bullet passed through the first two rings of the trachea, which were fractured, and the esophagus, and embedded itself in the body of the first dorsal vertebra. Tracheotomy was performed, but the man expired sixty hours after the injury. The notes state that the sergeant had been doing his duty up to the time of his wound, and there was nothing to show that he had ever suffered any inconvenience. Sections made from the cord several segments above and below the lesion showed, however, an extensive syringomyelia. The changes found are described at great length in this case. In a Mallory section from the sixth cervical segment, was a cavity involving the central region of the cord, which could contain an ordinary pencil. The degenerative conditions are briefly as follows: (1) The total destruction of the central half of the posterior columns on the left side, and a scattered degeneration throughout the remaining portion. (2) The central half of the posterior columns on the right side, excepting a small zone in the lateral region, are completely gone, and there is a scattered degeneration among the remaining fibers. (3) A slight scattered degeneration in the left antero-lateral regions from the neuroglia proliferations.

*Case I' (7 days).* Extensive bullet wound of the head involving the left parietal and occipital regions. Death occurred one week after the injury. The investigation of the brain was not completed, but that of the cervical and dorsal regions of the cord showed practically the same conditions as those found in the previous cases. Myelin balls form long rows along the fibers. Formation of the myeloclast is to be observed as well as the ameboid-like activity of the glia cells. The condition is not quite so advanced due to the fact that in Case IV the injury involved the spinal column while in this instance it involved the brain.

*Case VI (11 days).* The injury was caused by a bullet which penetrated the spinal canal at the level of the seventh cervical segment. The patient survived for eleven days. At autopsy it was found that half of the cord at the level of the lesion had been destroyed, and that the bullet had embedded itself in the spinal column.

A few sections stained by the Pal Weigert cosin method were forwarded to the laboratory for examination. The conditions found in these sections are as follows:

At the level of the lesion, the seventh or eighth cervical segment, practically one half of the cord was destroyed. What remains of the anterior horn of the gray matter is greatly disorganized. The vessels are congested, and there is a diffuse hemorrhagic infiltration. The



posterior horn is absent. In the white substance only a small region lying in front of the anterior cornu remains normal. The anterior root zone shows marked degeneration, but the fibers of the direct pyramidal tract are less affected. There is no trace of the lateral column. In the posterior columns the lateral is completely destroyed, but some portions of the merian, which is extensively degenerated, remain.

In the other half of the section both the membranes and the roots are intact. In the grey matter very little pathological change is to be observed, excepting a small hemorrhage at the base of the anterior horn. Of the motor cells only the antero-internal group is affected, due probably to the degeneration of the commissural fibers from the opposite horn. The anterior commissure shows a large number of healthy fibers, but in the posterior commissure there is extensive degeneration. The posterior horn is normal. In the white matter the root zone is normal, but between the direct pyramidal tract and the gray matter there is an area of the degeneration. There is also some scattered degeneration throughout the anterior and lateral columns. The posterior columns show a hemorrhage near to the commissure which involves the neighboring fibers. Many of the endogenous fibers lying in contact with the horn are degenerated, and there is an extensive scattered degeneration throughout both the internal and external columns.

Transverse section of the fifth cervical, two segments above the lesion. In the pia surrounding the cord, in the fibrous prolongations into the white substance, are many small hemorrhages. Throughout the white substance at the periphery are numerous patches of degeneration. Many swollen fibers exist and some have fallen out giving a vacuolated appearance.

The gray substance of the anterior horn is more or less degenerated. The posterior horn unaffected.

Various stages of degeneration in nerve fibers are described, and illustrations given of the formation of the myeloclast. Besides these changes in the fibers the glia also shows some interesting developments. The numerous open spaces scattered through the section where the nerve fiber has fallen out are surrounded by a glia structure which had previously formed the sheath of the nerve. Within this glia ring which is generally thickened, fine fibers are frequently observed. These usually make their first appearance at the circumference where they form a network which gradually extends until the space becomes filled up. Sometimes, though, one or more fibers will bridge across the opening, and from these others will be formed till a firm interlacing structure fills the space. A similar condition is also to be observed where the neuroglia has been torn. Through this neuroglia proliferation the damaged structure of the cord is bound together with a firm tissue which will eventually develop into a sclerotic mass. These changes are of particular interest in that they have been observed in a case of eleven days. It is, though, only another of the many evidences which show

that the stages of degeneration in these traumatic cases vary greatly from the usual type.

Degeneration was found in sections from the third dorsal segment, and less and less down to the eighth and ninth which showed practically a normal condition.

*Case VII (7 weeks).* Bullet wound of the spinal column at the level of the twelfth dorsal vertebra. The skiagraph showed twelve large fragments and several small ones in this region. After an illness of several weeks, during which septicemia and broncho-pneumonia developed, death occurred. The post mortem showed a chronic purulent inflammation within the spinal canal. On opening the thickened dura there was much congestion of the surface of the cord and among the roots descending into the lumbar plexus. The greatest thickening was over the third, fourth, and fifth lumbar and first sacral segments. The cord was firm and on section showed no areas of softening to the naked eye.

All the early stages of the degenerative process are represented from the first disturbances of the axis cylinder and myelin sheath, to the myelin balls and myeloclasts. In addition to this we find the second form of scavenger cell present. This is seen in the stage of its formation when a glia cell rich in protoplasm surrounds a myeloclast, or where several glia cells each surrounded by a protoplasmic body enclose within their processes several myeloclasts. Some of these myelophagocytes have evidently been active for some time, as the myelin has been broken up into small masses which are sometimes shown as bright yellow balls within the blue protoplasm of the cell, or in the Marchi preparations as black fragments. Proliferation of the glia cell by mitosis is also to be observed in this section.

*Case VIII (2 months).* In this case the wound was from a shrapnel bullet which struck the vertebral column, just below the spine of the left scapula. There was immediate loss of power in the arms and legs, associated with retention of urine. Sensation was lost up to fourth cervical segment. X-rays showed the bullet to be lodged in the canal just to the right of the spinous process of the sixth cervical vertebra. laminectomy of the fifth, sixth, and seventh cervical was performed a few days later and the bullet removed. It was found within the spinal canal, lying to the right of the theca which appeared uninjured. After two months' illness, during which his condition got steadily worse, he died from respiratory failure. At the level of the injury, which involved the fifth and sixth cervical segments, the dura was strongly adherent to the pia, and the substance of the cord at this point was much damaged. On section gross macroscopic changes, softened areas, were observed extending upwards to the fourth cervical segment and downwards to the third dorsal. In the left posterior horn, extending from the second to the fifth dorsal segments, a small localized patch of necrosis was observed.

In all these later stages the early conditions are always to be found at the margin of the degenerating area. Thus we see again the axis cylinder and myelin sheath in various conditions, the myeloclast, and the early myelophagocyte which may still show within the enclosed myelin some axis cylinder fragments. In the later stages of the activity of this cell the axone has disappeared. The original irregular outline of the cell has now given place to a more or less rounded form. The homogeneous mass of protoplasm has also changed, fibers have been developed which have divided still finer the enclosed myelin masses, and the cell body shows a granular appearance. In this manner the granular cell is formed. Marchi preparations show the black staining degenerated myelin within these cells. In a few instances granular cells are found which are apparently undergoing degeneration. The cell body has lost its granular appearance. It has begun to shrink, and in the space thus left between the cell and its greatly thickened surrounding structure of neuroglia tissue, fine fibers begin to make their appearance. These develop in the form of a network around the circumference. This represents the earliest manifestation of the final stage.

*Case IX (4 months).* The injury was caused by a rifle bullet which traversed the back of the neck, fracturing in its course the spinous processes of the sixth and seventh cervical vertebrae. Immediately following the injury he was paralyzed from the waist down, but could move his hands and arms. After an illness that lasted for four months, which was complicated by incontinence of urine and feces, the development of severe trophic disturbances, abscesses over the hip, and a large abscess in the abdomen, death occurred. At the post mortem it was found that the greater part of the seventh spine had been shot away, and that the caudal half of the sixth and the laminae of the seventh were soft and friable. An irregular transverse fracture was visible across the laminae of the sixth, with crushing on either side of it. The bodies and transverse processes of these vertebrae were not affected. From the second dorsal segment to the sixth cervical the cord looked bruised. Below and above this area it appeared quite normal.

The conditions observed here differ from the previous cases only in the more advanced state of the degeneration. The degenerated area is occupied by a mass of granular cells. In some regions the debris has all been removed, and the irregular broken-up condition of the disintegrated mass has given place to an ordered state in which there is a great proliferation of fibrous tissue. From this time on a regular progress will be made until the affected area has become completely sclerosed.

In the cases of 10, 24, 48 and 60 hours, the disturbances described were directly caused by the shock of traumatism; and the term "traumatic degenerations" is suggested by the writer to distinguish them from the usual secondary form. The article concludes with considerable discussion of the investigator's findings and of the subject of traumatic shock and concussion.

C. E. ATWOOD (New York).

**Sanz, E. F.** ACUTE MALARIAL ATAXIA. [Siglo Med., Vol. 64, 1917, No. 3322, p. 586.]

A short case report of a subtertian malarial patient with severe somatic evidences of cerebrospinal involvement, chiefly showing as ataxia, and speech defects. Continuous and intensive treatment by quinine and sodium cacodylate finally cleared up what had appeared a refractory state.

**de Brun, H.** MALARIAL TREMORS. [Bull. Acad. de Med., 1918, Mar. 26, 3 Ser., Vol. 79.]

Malarial tremor according to de Brun is extremely frequent in chronic cases. The limbs only, are usually involved, and the upper extremities more often than the lower. The head is rarely involved, but the tongue may be affected, and there may be nystagmus. The tremors are exaggerated by efforts demanding precision and concentration, painting, writing, shaving, and similar fine movements may be impossible; thus the tremor is intensified by fatigue and by emotion. It is not rare, in cases of long duration, for crises to occur; such crises may be sudden and unaccountable, and may last for several weeks.

**Moiner-Vinard, R.** MEDULLARY INVOLVEMENTS IN MALARIA. [Revue Neur., Vol. 24, 1917, Aug.]

The author has dealt with 64 neuropathic cases of malarial origin in most of which parasites were demonstrated. He arranges them in the following series: (1) Painful muscular cramp usually limited to a single muscle or group of muscles, but in one case affecting almost all the muscles of the body. (2) Hypertonic muscular rigidity, commonly of all the limbs, and sometimes lasting for 2 or 3 months. (3) Motor asthenia, sometimes so extensive that the patient can hardly move and is quite unable to stand upright. (4) A combination of the foregoing. (5) Sensations of cold and creepiness in the extremities. (6) Anesthesias of various kinds. (7) Vasomotor and local circulatory disturbances and their sequelae. In all the patients observed electrical reactions were more or less abnormal.

All these neuropathic perturbations are to be regarded as of the nature of reflex paralysis probably due to functional derangement of the central nervous system. This functional disturbance is not directly due to the malaria parasites, and is not controlled by quinine, but resembles in a general way the disturbances caused by other specific infections and toxins.

**Steinke, C. R.** SURGERY OF POSTERIOR SPINAL ROOTS. [Surg. Gyn. Obstet., 27, 1918, No. 1.]

The author here gives an extended résumé of the Förster operation, reviewing the work of forty-seven different operators. The amount of root resected by different surgeons varied from 3 mm. to 3 cm. In

spastic diplegic cases, four were entirely relieved of their spasticities, fifty greatly improved, and forty-seven somewhat improved. In the tabetic cases fourteen were relieved of their crises, and in thirty-seven the crises were less frequent or less severe. Mortality was not high. Steinke concludes that the operation of resection of the posterior spinal roots when properly performed technically and logically applied may be of great service.

**Abramson, H. L.** SPECIFIC PREVENTION OF POLIOMYELITIS. [N. Y. Med. Jl., Aug., 1918.]

This paper presented only the salient facts brought out in work extending over a period of two years, and dealt with efforts made toward the development of a method for protection against acute poliomyelitis. The first effort in this work consisted of an attempt to adapt the virus of poliomyelitis to the rabbit, but after rather extensive experience with this animal it was found to be unsuitable. Attention was then directed to the use of monkeys of the rhesus variety. This animal, as had been amply demonstrated in a wealth of experimental work, was highly susceptible to experimental poliomyelitis. The virus of poliomyelitis used was obtained from the Rockefeller Institute and was of such potency that .05 c.c. of the supernatant fluid of a centrifuged five per cent. emulsion inoculated into the brain of a monkey produced a fatal poliomyelitis infection. This virus had passed through a large number of monkey generations at the Rockefeller Institute and through ten additional generations at the Board of Health Laboratory. It was very reliable and had not yet failed to produce lethal poliomyelitis in normal animals that had been inoculated intracerebrally with .05 c.c. or more of a five per cent. emulsion. It was decided that the injection material ought to be modified or attenuated in some manner so as to remove any possibility of harm from the method itself. Also, in order to render the emulsion utilizable in time of epidemic, it was decided that the time consumed in administration of the method ought to be as short as possible consistent with the production of a degree of immunity sufficient to protect against a reasonable exposure to the disease.

The first method tried, an effort to attenuate the highly potent monkey virus by exposure to formalin, which was later removed by dialysis, was not satisfactory. Two other methods were tried, the killed virus method and a method involving the use of virus subjected to graded heat with a final injection of unheated material. The first produced some immunity, but not of a high degree. The second produced protection of considerable degree against an unusually severe method of testing, the sera of these animals all containing neutralizing substances, but in varying degree. The latter method also produced no ill effects as a result of the treatment itself; the injection of graded attenuated material prepared the animal to take care of the final injection of live virus it produced sufficient immunity to protect animals against

a multiple intracerebral dose of a highly potent virus, which was a hundredfold severer exposure than that to which persons were exposed in the natural infection; and it produced neutralizing substances in the blood in such concentration as should be amply able to combat the comparatively mild infection which might lodge on the mucous membrane of persons exposed to poliomyelitis. Furthermore, the series of infections were completed in five days, which rendered it highly practicable in time or epidemic. It could be easily prepared from the glycerolated virus which might be kept on hand over a long period of time without deterioration and required only moderate laboratory facilities.

**McCann, Gertrude.** MITOCHONDRIA IN POLIOMYELITIS. [Jl. Exp. Med., Vol. 27, 1918, p. 31.]

Mitochondria were plainly visible in the spinal ganglia cells of monkeys who had experimental poliomyelitis. In the usual cell mitochondria and small Nissl granules are very similar but they persist after the disappearance of the typical Nissl granules and in cells undergoing neurophagia mitochondria threads are not infrequent in the protoplasm. [J.]

**Regan, J. G.** MACEWEN'S SIGN IN POLIOMYELITIS. [Am. Jl. Children's Dis., July, 1918.]

This sign was tested by the author in 1798 patients during the epidemic in 1916. In the preparalytic stages he found it fairly constant and definite. In the early paretic phases its presence was demonstrated in 80 per cent. of the cases. Its persistence in respiratory cases was a marked characteristic. The degree was proportionate to the pressure and quantity of spinal fluid removed. When Macewen's sign was marked, the fluid was usually under marked pressure. If slight the fluid would merely flow rapidly.

## 5. CEREBELLAR SYNDROMES.

**Kirmisson, E., and Trétiakoff.** ECTOPIA OF THE CEREBELLUM IN AN INFANT OF TEN WEEKS. [Arch. de Méd. Des Enfants, 1917, XX, p. 412.]

A rather puny, bottle-fed infant girl had what seemed to be an enormous meningo-encephalocele of the occipital region, situated slightly to right of the middle line. Patient's father unknown: mother has good health, but has a dermoid cyst of eyebrow. The tumor was biloculated, 6 cm. long, 13 cm. circumference. Skin over its free portion was very thin. Its tension was not very great: still, pressure over it was transmitted to the anterior fontanelle. It seemed transparent, and was thought to contain no nerve elements. It was irreducible, and pressure on it failed to produce convulsions. There were also some palatal anomalies. As rupture was feared on account of the thinness of its coverings, and there was an absence of cerebral symptoms, opera-

tion was performed. For ten days good progress; then severe gastroenteritis, and death on nineteenth day after operation. Necropsy: almost the whole of cerebellum was included in the tumor, so that it was really an ectopia cerebelli. Histological study proved that the portion of nervous tissue which formed part of the hernia belonged to the cerebellum. Cerebellar convolutions were found, cut in various directions. On closer examination, two sets of convolutions were found; some corresponded exactly in the structure of their cerebellar layers to those of a full-term child, with their layer of superficial granules, molecular layer, layer of Purkinje cells well developed and provided with axons, layer of deep granules, and finally a layer of myelinated fibers; but in other places the granule layer is thinned and disappears, and the deep granule layer is less numerous than normal, Purkinje cells are too small and have hardly their proper shape. A full description is given of the cerebellar peduncles, pons, and other parts of the brain.

LEONARD J. KIDD (London, England).

## 6. BRAIN AND MENINGES.

**Marchetti, O.** MENINGITIS SEROTHERAPY. [Rev. Cr. d. Cl. Med. Flor., Vol. 19, 1918, June.]

In the treatment of epidemic cerebrospinal meningitis Marchetti alternately injected the antimeningococcus serum venously and intraspinally. One of the eleven patients died and this one had malaria. The general symptoms grew milder under this alternate treatment, the course of the cases averaging five days less than in a parallel series which was given intraspinal injections. The largest amount of serum used was 280 c.c., the average being 238 c.c. with 125 by the vein and 113 by the intraspinal route. The drop in the mortality was from 53 to 9 per cent., and invites more careful study of this technical variation.

**Ramond, Félix, and François.** INTRA-SPINAL INJECTIONS OF STERILIZED AIR IN TUBERCULOUS MENINGITIS. [Bull. et Mém. Soc. Méd. Hôpitaux de Paris, 1917, XXXIII, p. 1058.]

Ramond has for two years obtained benefit from intra-spinal injections of sterilized air in tubercular affections of peritoneum, pleura, and testis; and siçard also in dogs. This treatment is harmless by Ramond's technique:—lumbar puncture in decubitus, as much as 40 c.c. of spinal fluid being removed; twenty c.c. of sterilized air or oxygen is injected, as follows: it must be warmed, for, if cold, it dilates suddenly in the spinal canal and so causes compression. The air is aspirated into a Roux's syringe, and traverses a long platinum needle brought to a red heat in order to sterilize and warm it; for injection it should be of the body temperature. When thus prepared, it is sent slowly into the spinal canal by the puncture needle left in place. Injection can be repeated after five or six days, for sterilized air; but for oxygen, it can be continued indefinitely. Ramond's experience is that definite benefit, but not

yet cure, follows these injections. In cases of tubercular meningitis the writers have used small doses of air, viz., from 2 to 15 c.c. The latter dose was borne perfectly and gave an unlooked for benefit. Further, Ramond has shown that injections of sterilized air are perfectly borne when given by means of puncture of the lateral ventricles. Clearly the writers believe that one day we shall master tubercular meningitis by attacking it at an earlier period of its course than our present diagnostic skill permits. LEONARD J. KIDD (London, England).

**Legry, T.** HEMIPLEGIA DUE TO A LOCALIZED FOCUS OF TUBERCULOUS MENINGITIS. [Bulletin de l'Académie de médecine, May 21, 1918.]

The author notes that in tuberculous meningitis in adults the lesions are apt to involve circumscribed portions of the cortex, the symptoms correspondingly resembling those of focal changes. He reports the case of a woman of thirty-one years admitted to a hospital after having for two months experienced lassitude and for a week, at intervals, tingling, beginning in the distal portions of the left hand and foot and extending to the entire left half of the body. Examination showed an exaggerated knee jerk and a positive Babinski on the left, with diminished sensation and motor power on that side, the leg dragging during locomotion. Movements of the left arm were also limited. The temperature was normal. A diagnosis of specific hemiplegia was made and biniodide injections instituted. In the succeeding days the motor power diminished further; but there was no vomiting, neck rigidity, nor Kernig sign. Ten days after admission the temperature rose to 39° C. and paresis of the right leg appeared. Lumbar puncture revealed marked hypertension, pronounced lymphocytosis, and tubercle bacilli. The meningitic syndrome became complete only four days later, and after a like period the patient succumbed. The autopsy showed a few small tuberculous lesions in the lung apices. On the upper border of the right cerebral hemisphere was found a thick, granulomatous area slightly smaller than a silver half dollar. A few grayish patches representing incipient tuberculous granulations were noticed in other portions of the pia mater.

**Brosius, O. T.** A REPORT OF AN UNUSUAL CASE OF CEREBRAL MALARIA. [Proc. Med. Assoc. Isthmian Canal Zone, 1916, July to Dec., Vol. 9.]

This case is of interest because of the fact it occurred with an epidemic of anterior poliomyelitis. The patient, a girl of 11 years, exhibited along with a febrile temperature the following symptoms: Supine semiconsciousness, with the head retracted, the neck rigid, and the eyes rolling upwards; the right arm and leg in a state of flaccid paralysis; no knee-reflex on either side; Kernig sign on the left side. After a careful physical examination, a blood smear was made and revealed both benign tertian rings and subtertian crescents; and a lumbar puncture was made with a negative result for microorganisms. The case responded to quinine, and on the fourth day of treatment she had practically regained her normal state.



**Hutinel.** ACUTE MENINGITIS IN CONGENITAL SYPHILIS. [Presse médicale, April 22, 1918.]

Attacks of meningitis in the presence of congenital syphilis are by no means rare. Some are insidious and latent in type, others, occurring among older children, may simulate tuberculous meningitis, at times so closely that confusion is practically unavoidable. The condition should be borne in mind especially when the clinical picture in a case of meningitis presents unusual features, when the child shows suspicious evidences of syphilis, when his heredity is doubtful, and especially, when recovery occurs. Even in the presence of what appears to be a tuberculous meningitis, running a regular course and the diagnosis of which is almost certain, it is wise not to render a definite diagnosis too soon, for such a diagnosis implies a fatal termination. Whenever any doubt is felt, specific treatment should be at once instituted, beginning with mercurial inunctions while awaiting the opportunity for more vigorous measures. Such inunctions have no prejudicial influence in tuberculous meningitis, and may cause rapid improvement in syphilitic meningitis, thus revealing the nature of the disturbance.

**Mathers, G., and Herrold, R. D.** MENINGOCOCCUS CARRIES AND BACTERIOLOGY OF EPIDEMIC MENINGITIS. [Jl. Infect. Diseases, June, 1918.]

These authors made an extensive bacteriologic study of epidemic meningitis in large military camps in 1917. The meningococcus carries identified and isolated. Plain blood agar was satisfactory and the culture material obtained from the nasopharynx. Three to six per cent. of the men examined were meningococcus carriers. The majority, however, being of the temporary type. One half per cent. of the suspects examined are chronic carriers. Chronic meningococcus carriers, distinguished from the temporary type, carry large numbers of meningococci in the nose and throat. The number of carriers was found to be high among those coming in contact with meningitis cases. These facts suggest that there is a close relationship between cases of epidemic meningitis and meningococcus carriers.

**Descomps, Euzière, and Merle.** CONVERGENT PARALYSIS FROM CEREBRAL COMMOTION. [Bull. de la Soc. Méd. d. Hôp., April 26, 1918, 42, No. 14.]

After the Barany rotation test marked convergent palsy may be noted in cerebral concussion, persisting 10-90 seconds. The nine cases described by these authors this convergence was the only sign of injury of the oculomotor in four, but in five there was paresis of other oculomotor nerves. The writers regard the convergence as a paralysis, and explain its mechanism in terms of Dejerine's findings and not referable to internal ear disease. These patients were *commotionnés*, and some had traces of evident organic central lesions from contusion. This convergence sign is a manifestation of minute focal lesion.

**Freymuth, Otto G.** AN OBSCURE CASE OF SUB-DURAL ABSCESS OF THE BASILAR FRONTAL AND LEFT TEMPORAL AREAS. [Pacific Med. Journ., 1917, LX, p. 538.]

Patient was a single man of about 45; admitted in semi-consciousness. No data obtainable of past history, present illness, or family history. The tentative diagnosis was a possible meningitis. No scars or traces of injury; much emaciated; skin sallow and dry; lax dorsal decubitus; no restlessness or apparent distress; expression apathetic; cannot speak, write or express himself by countenance. Viscera, temperature, pulse normal; blood pressure 135 and 80; slight arteriosclerosis, perhaps not more than physiological; sensibility not testable; all reflexes normal; right optic disc and suspicion of congestion, left, a pronounced central area of secondary atrophy; muscles flaccid; apathy and lethargy; mental state ranges from semi-consciousness to stupor; blood and spinal fluid negative Wassermann and Noguchi; no abnormal spinal fluid pressure; cell count twelve, the globulin negative; urine high-colored, but not pathological. Diagnosis uncertain; possibly intra-cranial neoplasm. Death in a week. Necropsy: Dura much congested. On opening it, much pus exuded from left side. The whole left cerebrum bathed in pus. Cortex much congested, arterioles pronounced. Abscess cavity in base of left frontal lobe, a small channel extending backwards to the base of the temporal lobe and the contiguous upper border of left cerebellar lobe, the tentorium cerebelli forming the septum. Right brain normal; no intra-cerebral or ventricular changes. During life an exploratory decompression was seriously considered, but diagnosis was very difficult, and nothing pointed definitely to abscess. The writer thinks that whenever confused mentality is accompanied by choked discs, whether in traumatic or non-traumatic cases, decompression should be performed. Possibly relief might have followed an immediate decompression in this case, but the writer feels that, on account of the extensive cerebral involvement present, no benefit would have been gained.

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**Pitres, A., and Marchand, L.** PSYCHIC SEQUELAE OF SKULL AND BRAIN INJURIES. [Presse Médicale, May 16, 1918, 26, No. 28. June 6, 1918, 26, No. 31.]

In an examination of 470 soldiers who had recovered from the surgical incidents of their skull wounds, all had had and many still had headache, vertigo, physical and psychic depression and inability to stand noise corresponding to the well-known *syndrome commotionnel*. This syndrome persisted up to twenty-two or thirty months after their injury, but this duration was rare. As a rule these symptoms disappear entirely by the end of a year, but even then the soldiers are extremely sensitive to noises and to any work that requires stooping over. Such soldiers should never be utilized as aviators or chauffeurs. Rest is the main treatment.

## III. SYMBOLIC NEUROLOGY

## 1. PSYCHONEUROSES AND PSYCHOSES.

**Waller, A. D.** DEMONSTRATION OF THE PSYCHO-GALVANIC PHENOMENON. [Proc. Physiol. Soc., J. Physiol., 1918, 52, VI-VII.]

This is a report on a modified repetition of a demonstration to the Royal Society in November, 1917. The subject is placed in the *x* arm of a Wheatstone's bridge, and the resistance directly ascertained at the outset of the observation by finding the resistance value for no deflection of the galvanometer. Any emotive reaction of the subject causes a deflection of the galvanometer, which can be calibrated for photographic purposes or can be directly estimated by comparison with the deflection caused by plugging or unplugging any convenient value at the resistance box. [Phys. Abst.]

**Dupré.** THE EMOTIONAL CONSTITUTION. [Bulletin de l'Académie de médecine, April 2, 1918.]

This author describes, under the appellation "constitution emotive," a special type of loss of nervous equilibrium characterized by diffuse erythism of general sensibility, sensory and psychic, and by insufficiency of motor inhibition, reflex as well as voluntary. A high degree of emotivity is normal in the nursing and frequent in childhood, but disappears in the adult owing to development of the inhibitory functions. Abnormal emotivity in adults, while generally inherited, may be acquired through the operation of infectious, toxic, and especially traumatic, influences. Repeated emotion may either thus sensitize the nervous system to subsequent emotions or create a species of emotional immunity. The physical signs of the emotional constitution comprise a diffuse exaggeration of the reflexes; sensory hyperesthesia, with sharp and prolonged motor reactions; a lack of motor equilibrium, manifested in visceral spasmodicity, e. g., pharyngoesophagism, gastroenterospasm, cytospasm with pollakiuria, and palpitations; emotional tremor, shivering, stammering, tics, etc.; functional inhibitions, with temporary weakness of the lower limbs, mutism, and relaxation of the sphincters; disturbances of circulatory equilibrium, such as paroxysmal or permanent tachycardia, instability of the pulse, alternate peripheral vasoconstriction and vasodilatation, and dermatographism; local variations in temperature, with subjective sensations of cold and heat, principally in the extremities; spontaneous or emotional variations in the rate of secretion of glands; disturbances in intervisceral reflex actions along the vagosympathetic or cerebrospinal nervous pathways. The psychic signs are abnormal impressionability, anxiety, and impulsive actions, more or less continuous or paroxysmal. Upon these as a foundation arise timidity, scruples, doubts, obsessions, phobias, simple or delirious states of anxiety, and psychosexual aberrations. In the most severe cases there appear attacks of anxious melancholia and chronic obsessional

states passing into incurable deliria of autoaccusation, hypochondria, or negation. The condition as a whole frequently occurs in association with neurasthenia and hysteria, but must be clearly distinguished from them. An essential feature of the emotional constitution is that it represents, not organic lesions, but deficiencies of functional equilibrium. When clearly recognized by the physician in given case it enables him to understand the patient's entire personality.

**Valdizan, H.** NEUROSES IN OLD PERU. [*Ann. d. l. F. Med.* Montevideo, I, 1918, No. 1.]

The history of hysteria and epilepsy in Peru, during the seventeenth and eighteenth centuries is here given by the author. In many particulars the reported miracle cures follow the usual rules which are known in the history of France during the fifteenth and sixteenth century.

**Bernheim, P.** PAINS AND AUTOSUGGESTION. [*Progrès Médicale*, Vol. 33, 1918, 21, May 25.]

This author gives some examples of what he erroneously calls [There are no imaginary pains—or rather all pains are always mental images, but of different causation. Bernheim here would best utilize the term psychogenic pains] imaginary pains, pains grafted on a primary organic pain from some lesion. Two of the patients nine years old; one screamed whenever the umbilicus was touched [why B. does not seem to know]. A small healed excoriation explained the trouble. The other complained of pain in the back and hand, sequels of acute articular rheumatism. In the adults the pain developed after a physical effort or joint lesion. In each case waking suggestion cured the pain immediately, or it subsided more gradually, but all yielded in time. In another group of cases the psychogenic pain, following some fall or gunshot wound or without appreciable organic lesion, had lasted up to twenty years, and had become compulsory. Bernheim then gives a naive interpretation which explains nothing and then goes on to say that every psychoneurotic pain, single or multiple, primary or secondary, is amenable to psychotherapy unless of such long standing that it has become an obsession as it were. It is important to recognize the nature of these disturbances; when the physician tries one remedy after another on the assumption of an organic basis and the patient feels no relief, the latter is confirmed more and more in the belief that his pain is obsessive.

**Damaye, H.** WAR NEURASTHENIA. [*Progrès Médicale*, 33, 1918, May 25.]

In an analysis of 123 patients in the Amiens section suffering from what Damaye terms "neurasthenia" a partition is made into pure and mixed cases. The fatigue develops along four different lines according as it affects the predisposed or develops after a concussion or bom-

bardment or after a skull wound. The symptoms became attenuated in the majority of cases under treatment with quiet and repose and from his descriptions any combination that fusses over the patient a great deal—pachs, injections, etc.

**Jelliffe, Smith Ely.** THE EPILEPTIC ATTACK IN DYNAMIC PATHOLOGY. [N. Y. Med. Jl., Vol. 108, 1918, July 27, p. 139.]

Jelliffe again calls attention to the desirability of studying disease from adynamic and functional point of view. Structural facts, while of moment and in need of careful description and accumulation, are of value only when viewed as the available material to carry out the work of the individual. The job, i. e., the function, the wish, is the important presursor in all medical injury. What the structure is to carry it out is the next problem. Hence Jelliffe following out the formula that man is an energy system, for the capture, transformation and release of energy, restates the view that the epileptic phenomena are simply symptomatic indices of faulty energy release. That this faulty energy distribution—whether shown in faulty social behavior, as in the well known epileptic fugues, in disordered sensori-motor reactions—the clotted mass of movements of Hughlings Jackson, or in perverted metabolic activities, are functional results of maladaptation of wish to machine. The machine is more or less bound down by what is in it—the reactions of the fixed organs are limited in their changability—but the more labile and fluctuating nature and hence greater capacity for modifiability makes the search for the wish factor of primary importance. Hence, while not disregarding any by the physical, chemical nor biological factors, the author maintains that these are capable of interpretation only from the standpoint of the latest evolution any product of nature, mental facts. Hence if the mental fact end is gotten hold of first, then the others are capable of being understood and only then cannot only the epileptic phenomena be understood and capably essential modification, but all disease processes as well. The most essential series of mental facts are not those of conscious, every day superficial knowledge, most of which are the flotsam and jetsam of individual bias and need. The real search begins with the study of unconscious processes in their effort to release energy through adaptive social conduct. Thus the program sketched is to first occupy oneself with the methods of the unconscious, and then it becomes more possible to adapt the patient's structural machinery to his longings and goals.

**Hallock, F. M.** COMPULSION NEUROSIS. [Neurolog. Bulletin, Vol. I, No. 5, 1918.]

A young man, twenty-three years old, had always been in excellent physical condition, but from early boyhood had suffered from a compulsion neurosis. This manifested itself in an overwhelming desire to touch certain things that he saw, or a compelling curiosity to find out

the contents of packages, the details of small transactions that he saw occurring between strangers, such as how much money a customer would spend in a shop, etc. When through shame or fear he was unable to satisfy his curiosity he became intensely uneasy, "wild" as he expressed it, he became short of breath, and could not sleep at night because of the insistence of the impulsion. Acts, which in the nature of things were prohibited, seemed to be the ones that created the impulsion. This case is one of many that ought to be recognized and cured in the early years of their development.

JEAN STAIR.

**Ames, T. H.** THE PREVENTION OF WAR NEUROSIS, SHELL SHOCK.  
[Canadian Medical Assoc., N. Y. Med. J., July 6, 1918.]

Doctor Ames said that although he had not been at the front, he had gained a considerable amount of experience concerning the effects of shell shock, having witnessed a large number of cases of neurosis arising from it in returned soldiers in the hospitals of Montreal and Toronto. Such neuroses only occurred in some regiments and not at all when organic disease was present. Discipline played a great part in the prevention of war neuroses, but discipline alone was not sufficient to prevent their occurrence. Men should be eliminated in medical examination for the army, whose nervous temperaments were unstable, while mental deficiency, and insanity should absolutely preclude admittance. Men who have had neuroses but who had completely recovered might be favorably considered. A large proportion of cases of neurosis might have been avoided had the patient been assured by one who understood and in whom he had confidence that fear was nothing to be ashamed of. The medical officers had something to do with the state of affairs. There were some men who exerted control over soldiers. When neuroses were frequent, the medical officers were to a large extent to blame, and authorities went so far as to say that shell shock should be always warded off if the men were properly looked after. The line officers were equally responsible for the outbreak of neuroses in a regiment. They should assume responsibility for the welfare of their men and take a personal interest in them. The lieutenants and noncommissioned officers, being most intimately in touch with the men, it was in these reliance must be placed to prevent neuroses. They should make themselves acquainted, as far as possible, with their men, and should behave to them as if they were human beings like themselves, and not as merely cogs of the machine. The slightest change in a man's demeanor or habits should be reported immediately. The line officer rather than the medical officer had the first opportunity to notice any such change. The man should be given something to interest him, to divert his mind from introspection, put between two veterans, in fact every means taken to distract his attention from himself. Sharp reprimands, so as to bring about a reaction, sometimes served this purpose. Chatting with some, joking with others, and speaking sharply to

yet others. They must be dealt with according to their several temperaments, and whether they had neuroses or not, nearly entirely depended upon their officers. Rarely had officers of this stamp to say: "If you do not carry on I have a bullet for you here." They induced the men to relieve themselves of the burden that oppressed them. The medical officers did not have such constant opportunities of watching the men, but when sick they had somewhat exceptional ones for becoming acquainted with their idiosyncrasies. The human mind was always peculiarly open to suggestion. The soldier was so, in particular, and the sick soldier preëminently so. Moreover, they believed in their medical officers. Subjection to strict discipline, the fear of severe punishment or death from allowing their emotions to run riot, had a strong restraining influence. Training of the body and mind tended to keep up morale. The life of the soldier was apt to lead to the unleashing of the primitive emotions and especially of that of fear. Soldiers could be prepared to be harassed by Huns. They could be prepared to combat fear successfully or to hold in check sex emotions. They could be taught that discipline was both for the good of the state and themselves. They should be taught the cause and origin of neuroses by the medical officer and told that fear is a normal healthy reaction, in the presence of danger, and came to all except to the insane and the liar. A discussion of fear did soldiers much good. When they knew that every one was doing his bit, the knowledge gave them confidence, and confidence was essential. Officers, then, were responsible for the existence of neuroses in regiments, and the condition could be prevented by the establishment of confidence between them and their men.

**Leahy, S. R.** BORDERLINE PSYCHIATRY. [Neurological Bulletin, Vol. I, No. 5, 1918.]

In the borderline group of psychoses Dr. Leahy includes the various depressions, early dementia precox, some paranoid conditions, and the various neuroses all representing types of social maladjustment and maladaptation. These psychoses apparently result from the inability of the patient to correctly analyze the complexities and unpleasantnesses of the situation in which he finds himself and to see things in their true light. The inadequate and false analysis which he makes results in the abnormal acts which constitute the picture of his psychosis. In the dementia precox cases there is a distinct relation to the psychoneuroses, and it is often difficult to make a correct differential diagnosis. It is possible to formulate all of the mental symptoms in the same way that they are formulated in the psychoneuroses, and they are capable of interpretation solely at the psychological level. However, it must not be forgotten that recent investigations are tending to show more and more that there are distinct biochemical changes during life, and that pathological changes are found after death. These pathological findings must be conceived as being correlated with the psychic symptoms.

At present we are unable to make any specific correlation between the physical findings and the mental symptoms, but it is quite possible to reconstruct the psychosis purely in psychological terms. Dr. Leahy believes much can be done to benefit these so-called borderline cases by unearthing and discussing freely with the patient the conflicts which are the sources of his difficulties, and so modifying his mental trends by a process of reëducation and readjustment, based on a true understanding. By coöperation with teachers and parents in the early life of the child, much can be done to avoid the pitfalls of adolescence and later adult life. While analysis and uncovering of the painful situation is most desired, it may also be necessary to bring about a change in the environment or occupation of the patient. Two cases of borderline psychosis are reported.

JEAN STAIR.

**Russell, Colin.** THE PROBLEM OF THE RETURNED SOLDIER. [Tr. Ontario Med. Assoc., Canad. Med. Assoc., N. Y. Med. J., July 6, 1918.]

Lt.-Col. Russell's paper dealt with psychogenic conditions in soldiers, their etiology and treatment. The psychogenic conditions and the subdivisions of this type were described. Such conditions comprised physical and mental disabilities, but the futility of refinement of classification was obvious. Psychogenic conditions represent a conflict between the natural inherent instincts and the more lately acquired control of these instincts by the higher centers. The effect on the result of the conflict of deficient control was either congenital as in mental deficiency or due to lack of proper training as well as to natural exhaustion of the acquired higher control under prolonged strain. The defeat of the higher centers and the abolition of the critical activities of the censor rendered the patient open to suggestions that met the wishes of the conquering instinct. They varied in type from complete blindness to complete mutism and, curious to relate, all these types appeared in epidemics. During the early stages of the war, trench fever was remarkably prevalent. This type had almost wholly disappeared. The conditions follow-shell shock presented no physical or pathological symptoms. They simulated, however, a variety of pathological states. For example, convulsive seizures resembling epilepsy occurred sometimes subsequent to shell shock. These seizures differed from true epilepsy, in that the movements were purposeful, whereas, in true epilepsy, the reverse obtained. These conditions were classed formerly under the term hysteria. War had not been responsible for their initiation, but had aggravated inherent instincts. The treatment of such conditions consisted in putting down the usurping instincts and stimulating the higher centers to resume the duties allotted to them. The conditions of shell shock being often due to an idea, the treatment of these cases should be in special hospitals in charge of experienced men. An authority on the subject had stated that ninety per cent. of psychogenetic cases were capable of cure.



Attention was drawn to the fact that soldiers suffering from shell shock frequently had no inducement to dismiss the idea from their mind. On the contrary, from their point of view, if they did so they would be returned to the army, while, on the other hand, if they continued to harbor and foster the idea that they were shell shocked, designated by Russell as loss of control of mental intelligence, they would draw a nice pension. Several instances were given in which men presenting various symptoms, as paralysis and so on and who were by means of rational measures disabused of the idea that they were thus afflicted. It had been stated that shell shock cases disappeared from the French Army when a rule was made that a soldier claiming to suffer from it would not receive a pension.

**Lopez, J. A.** MOUNTAIN ENVIRONMENT AND THE BRAIN. [Sem. méd. Buenos Aires, 1917, 24, p. 407.]

Tests were made on a troop of cavalry during a series of encampments, amongst the Andes. The psychic functions, the intelligent respond to various tests, showed no change at various altitudes up to 3,672 meters. [A. M. A.]

**Licard, J. A., Roger, H.** BORDET-WASSERMANN REACTION OF THE CEREBROSPINAL FLUID IN GENERAL PARALYSIS. [Bulletins et mémoires de la Société médicale des hôpitaux de Paris, February 21, 1918.]

These authors obtained a positive reaction in the spinal fluid in 100 cases of paresis, and maintain that a negative reaction in a suspected case, especially if the test is twice repeated at weekly or fortnightly intervals with the same result, excludes a diagnosis of this affection. Such differentiation is now of especial moment, as certain concussion states more or less closely reproduce the symptoms of chronic diffuse meningoencephalitis. High albumin content of the spinal fluid generally accompanies a positive reaction; the albumin varies independently of treatment and depends upon the congestive attacks sometimes clinically noticeable in these patients. The Bordet-Wassermann reaction of the blood was positive in about ninety-five per cent. of the cases before treatment and in only thirty-five per cent. after vigorous intravenous arsenobenzol therapy. On the other hand, the same reaction in the case of the spinal fluid always remained positive after treatment, even when doses of arsenobenzol so large as to cause severe intoxication were used.

**Zangger, H.** COMPULSORY INSURANCE AGAINST ACCIDENT AND SICKNESS IN SWITZERLAND. [Corresp.-bl. f. Schw. Aerzte (J. A. M. A.), June 8, 1918, 48, No. 23.]

This article was the closing lecture of Zangger's course on the medical features of the new accident insurance legislation in Switzerland. He emphasizes the special points of difference in the medical

aspect of the case, between single private insurance and collective compulsory insurance. Knowledge of the accident process, that is, of the etiology of the disturbances noted, is all important. If a fracture occurs from a comparatively slight force, we can assume some special cause in the body, and the prognosis is modified thereby, as we seek to discover the predisposing cause. He reiterates the importance of the first examination, determination of the causal connection, for the insured know well that if they can once convince the physician, mislead him from the start, it is practically impossible for their malingering to be detected later, because the true causal connection then can no longer be determined, and also because the courts depend so implicitly on the findings at the first examination. No matter what other reports may be made later, the courts depend on the first report. If concussion of the brain, for example, is specified in the first report, nothing that can be said later will convince the judge that there had been no concussion. Many insured workmen plot how to get the physician to accept a *Kausalzusammenhang*, and physicians must be on their guard against being exploited in this way. By uncovering these would-be malingerers they also serve the state.

Zangger has encountered one case in which thirty different physicians had taken the patient's statements at their face value, and had certified to severe injuries from insignificant accidents, so that the man had been paid "compensation" at least twelve times by different railroads and tram lines. The first report should include specification of the present status from the standpoints of etiology, prognosis and treatment, with the data on preëxisting disease which introduced, occasioned or modified the accident. This includes the known affections, which might be concealed, the visible, which cannot be concealed, and the unknown affections, that is, those whose symptoms the patient misinterprets unconsciously or wilfully, or which had caused no symptoms until the accident, such as cerebral hemorrhage, perforation of the stomach, etc.

The Swiss legislation goes beyond any other in the world in accepting certain morbid conditions without visible manifestations as accidents entitling to compensation. This includes industrial poisoning from chronically acting poisons, such as is becoming more and more common during the war. A causal connection seems more probable when several in the same factory present an acute disturbance, with little or no fever, and look badly, with discoloration of the skin. The physician must draw on his knowledge of medicine, toxicology, hygiene and natural science to aid in discovering the cause, as the workman himself very seldom knows what is inducing the trouble, and may mislead the physician with honestly meant but erroneous deductions—workingmen usually regard as poisonous only substances that smell badly or induce nausea. Several poisonous substances may have acted together, thus masking the symptoms from each. Elderly persons, children and the young, and

those with cardiovascular disease may react to a poison in an entirely different manner from men in the prime of life. Nowhere else is the correct diagnosis so important for prophylaxis as with industrial poisoning. Sickness which is exclusively or predominantly traceable to a toxic acting substance ranks with industrial accidents in the Swiss law. Anthrax and glanders, on the other hand, have been dropped from the list for the present, but yellow fever, malaria, typhus and relapsing fever, befalling Swiss workmen in the employ of a Swiss firm anywhere are regarded as entitling to insurance benefit, as they are the result of insect bites. Some of the private insurance companies have already paid indemnities to policyholders who had contracted typhus during the war.

In concluding this comprehensive study of ways and means to discover the causal connection in the insurance sense, Zangger warns of the danger of crime and suicide being managed so as to present the evidence of an accident entitling to insurance money. He relates instances in which the criminals were actually being paid by the state for their crime, as when a woman caused the death of her husband by closing the damper in the stove. In several such cases, some causal circumstances first suggested suspicion, not the physician's report. The physician had accepted matters as he had found them on the surface. The identity of the corpse must be verified, as otherwise the indemnity might be paid for some policyholder who had merely left the country. He has had occasion to examine eight cadavers in which death occurred in an epileptic seizure. The mouth and nose in one case were plugged with the wet sand in which the body was lying, and the tongue had been bitten, but the family denied that the man was an epileptic. Inquiry in his home town in Italy revealed that he had long been subject to epilepsy. In conclusion, Zangger reiterates that the Swiss social insurance is on a more comprehensive scale than in any other country. It places great authority in the hands of physicians, and its success depends on them and especially on their report at the first examination.

#### IV. FORENSIC PSYCHIATRY

**Bowers, Paul E.** THE CRIMINAL INSANE AND INSANE CRIMINALS. [Am. Jl. Insanity, 74, 1917, No. 1.]

Many insane persons are being annually sent to prison to be punished for acts which are symptomatic expressions of unrecognized mental disease, while on the other hand sane criminals are sent to hospitals for the insane, because they are sharp enough to feign insanity. What is worse, dangerous insane persons are constantly being released upon the community, because they have been found not guilty since being insane they are held legally incapable of committing crime.

An unfortunate individual not infrequently commits a crime during

a recurrent episode of periodic insanity and is brought to trial during his well interval, hence is found sane and responsible.

Nevertheless the liberation of the victim of such disease is a dangerous matter for the community since who can tell when he may have another exacerbation and commit another crime.

The author, who is superintendent of the Indiana Hospital for Insane Criminals, finds that the three most important forms of mental alienation which lead to crime are epilepsy, paranoia and feeble-mindedness.

In epilepsy, an important point when called to consider responsibility for an act said to have been committed in pre- or postepileptic delirium, was the act in line with the habitual occupation of the individual? For example it would not be unnatural for an epileptic butcher to make an assault with a knife, while a poisoning by such an individual, we should be slow to regard as an expression of epilepsy. The paranoiac furnishes us with a large quota of crimes, probably the majority of them traceable to his delusions of persecution, or through expansive delusions of being called upon to act as the agent of God. The feeble-minded are especially addicted to crimes characterized by brutality and to sexual offences, although they are often cunning thieves too. Many pyromaniacs are feeble-minded. About 10 per cent. of the average prison population is insane. The felonies of the insane and mentally defective show a high percentage of crimes against the person. Among 169 insane prisoners 43 were murderers, 16 were convicted of assault and battery with intent to commit murder, 25 were burglars, 11 were convicted of rape or attempt at rape and 4 were convicted of sodomy. The ordinary hospitals for the insane are not suitable for insane criminals or malingerers, but an institution of special construction with a disciplined corps of attendants is needed.

C. I. ALLEN (Los Angeles).

**Adler, Hermann M.** OBSERVATIONS ON CRANIAL ASYMMETRY. [Am. Jl. Insanity, 74, 1917, No. 1.]

The author examined 1,000 patients at the Danvers State Hospital by means of the "Conformateur," the tracing apparatus used by hatters, and found that of them, 281 or 28 per cent. showed no marked asymmetry, while 719 presented marked asymmetry. Of 86 employees examined, only 5 showed marked asymmetry. He has usually found a greater prominence in the right parietal region in right-handed persons. It seems probable that asymmetry means an unequal development, and the author has gained the conviction that asymmetry indicates a variation from type, either in the direction of genius or in that of defect.

Marked asymmetry is a constant phenomenon in asylums and in criminal courts. The author has seen no cases of dementia præcox with the exception of the simplex or catatonic groups, which have not shown marked asymmetry.

C. I. ALLEN (Los Angeles).

## Book Reviews

**Robie, W. F.** RATIONAL SEX ETHICS. A Physiological and Psychological Study of the Sex Lives of Normal Men and Women, with Suggestions for a Rational Sex Hygiene. Boston, Richard G. Badger; Toronto, The Copp Clark Company.

This book presents a good deal of data in regard to the importance and form of manifestation of the sex life in every man and woman because the material is drawn largely from the testimony of healthy men and women as well as from those in whom neurotic disturbance has arisen. The author's plea is for a more rational and plastic attitude toward the sex problems, particularly the definite ones of marriage. This he bases upon the adaptability of so important a portion of the individual life as the sexual to varying conditions and demands.

His endeavor is to view and present the matter in the broader light, which refuses to be bound by petty limiting formulas and conventions of the attitude toward the details of sex activity and feeling. Considering these matters in their wider relationships he looks for the greatest ultimate good, particularly in the establishment and maintenance of lasting happy marriage. This but strengthens his emphasis upon those greater conventions, such as marriage itself, which have come into existence because of their social and individual usefulness in the sex life, and which make for a constructive permanency. His attitude is one which values the genetic development of sex life as of social life and therefore finds room for this adaptability of elements in the greater whole. Thus his discussion of auto-erotic practices, as he prefers to designate masturbation, thoroughly discountenances that traditional dogmatic condemnation of masturbation, which has been the source of much psychic disturbance. While there seems a tendency in some of his case discussions to lay too much stress upon this side of sexuality in certain secondary processes, yet he is clear in characterizing it as a feature of what has no place in perfect sexuality. It is at best a makeshift, a choice of lesser evils sometimes, in the varying and imperfect sex life of the race.

He has embodied the views of many writers on the subject of the sex life, some to prove their falsity, others to arrive at the fullest consideration of the subject. His partial divergence from Freud's conclusions is due to the full lack of appreciation of the place which the sex life holds in the entire psychological makeup. He fails at least to ex-

press the interdependence of this part with the whole, and also therefore of the many varieties of manifestation of sex interest or of the disturbances arising in relation to it. In discussing the factors which lie in point of time behind sexual manifestation, whether this is normal or disordered, or of the neuroses connected with it, he does not give room enough to the full content of the unconscious with its impulses. The viewpoint of the book however is that which will direct to human needs and its ultimate purpose is sound and wholesome.

L. BRINK.

**Scott, James George, Müller, W. Max.** THE MYTHOLOGY OF ALL RACES. In Thirteen Volumes. Louis Herbert Gray, Editor; George Foot Moore, Consulting Editor. Volume XII, Egyptian and Indo-Chinese. K. C. I. E. Boston, Marshall Jones Company.

The author of the first portion of this volume has succeeded admirably in presenting in a brief and popular but no less scholarly treatise such a difficult and extensive subject as Egyptian mythology. This he explains is impossible of concentration under one theory or system of understanding and interpretation. In its very history and essence it is as diverse and rambling as was actually the religious life of the ancient Egyptians, which maintained itself popularly through many centuries of history in many forms expressive of the thought and feeling of that long period with its many non-unified impulses. These created deities and myths which gradually arose and continued to exist side by side rather than in a gradual absorption of one by another, or of them all into a monotheistic or a pantheistic conception.

Such was peculiarly the character of the history of Egyptian religion and this the author has well portrayed in the plan of his discussion. He emphasizes in so doing these very peculiarities which mark Egyptian mythology and overthrows those forced interpretations which, from ancient classical times even to the present day, have attempted to discover a hidden spiritualism and sublimity under the guise of the crudities and materialism of their art and the customs and beliefs which are represented through it. Müller comes much closer to the actual source of the variety of beliefs and their crystallizations, when he makes them the expression of an equal variety and diversity of thought and experience arising out of successive periods of national life and modified through differing geographical and political divisions of the empire. He views this religion at no one particular crystallized epoch nor as the product of foreign influences nor as exerting as a whole system any marked influence upon other nations. It is rather to him indicative of a gradual and diversified growth of a great, a very ancient and a scattered people, who manifested a special capacity to hold tenaciously to old traditions and forms of belief more or less directly, and to graft upon these new conceptions without sublimating or submerging the old.

Hence the continued polytheism, actual rather than merely symbolic and emblematic, as some scholars and as the ancient Christian world tried to believe, and hence also the survival of animal forms mingled with human in their gods or the persistent worship of animals. True the author at times follows somewhat what seems a too rationalistic interpretation imposed by a later intellectual point of view, when he uses the nature interpretations. He fails to point out behind these the deeper psychic source within the human mind itself for what probably only later came to have a cosmic meaning. However, his presentation is so broad and candid an examination of facts that the field is laid open for the further thought and investigation, which he hopes from a future more sympathetic study of actual Egyptian sources.

As in the other volumes of this series the text is really replete with the suggestive facts of human attempt at self expression in gods and myths. The pages are full of the phantasy and symbolism which the psychologist finds still at work in the deeper layers of the human psyche, those depths where arise dreams of the night, daydreams and the pathological symptoms which are often created out of this material. The illustrations most happily interspersed throughout the text also peculiarly and often strikingly reveal the same elements and in certain instances are actually the pictured representation of some dream of today.

There is no lack of appreciation of the perhaps more classic presentation of the foregoing treatise, in admitting a special unique charm which pertains to the discussion of Indo-Chinese mythology. There are certain factors which make of this naturally a more popularly human story, which sparkles with a vivid reality of living beings impossible to carry across the centuries which have intervened since the Egyptian peoples lived out their faiths. The formal faith of the smaller groups which make up the Indo-Chinese peoples is much less ancient as respects their history. For even as they participate in the older religions of India and China their contact with them or their development of them after migrations and fusions of tribes is comparatively recent and also comparatively restricted especially as compared with the vast Egyptian nation.

Thus the author has not only the advantage of writing of peoples still living and enacting their childish beliefs but of these strangely mixed with the inroads of the white man's civilization among them. He has been able to get the myths as it were fresh from the soil, and has, one would think, personally watched the performance of prescribed ceremonials, and in these festivals and rustic shrines, in the tales of heroes and demigods, he has caught the very essence and flavor of the inner aspirations of the people. These arising from within seek at first these simpler and very direct means of expression. Here too the wealth of illustration in the book adds much to its spirit of present day

reality and the charming admixture of primitive faith and progressive contact with a more advancing conception of the world. The author insists throughout on the spontaneous origin of all these forms of expression, as indicative of the human psyche, and not to be fundamentally explained in borrowed forms nor in the later interpretations of advancing thought.

LAMBERTON.



# The Journal OF Nervous and Mental Disease

An American Journal of Neurology and Psychiatry, Founded in 1874

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## Original Articles

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### EROSION OF THE SKULL IN A CASE WITH A VARIX OF THE SUPERIOR SAGITTAL SINUS<sup>1</sup>

BY CURTIS E. SMITH, M.S., M.D.

PATHOLOGIST TO DANVERS STATE HOSPITAL, HATHORNE, MASS.

G. C. T. was the inventor of the braided wire picture cord. For a number of years he was manager of a large manufacturing concern until, at the age of fifty-one, he had a paralytic stroke. This resulted in a left-sided hemiplegia, which persisted until his death nineteen years later. He was unable to continue his work, and in November, 1916, at the age of seventy, began to show some mental impairment. He was sent to this hospital, May 24, 1917, and at entrance showed marked memory defect and confusion. Physical examination showed tortuous vessels about the forehead, and a lump the size of a guinea egg, bluish in color and pulsating to palpation, at the junction of the frontal and parietal sutures. The heart sounds were regular and of good quality. The blood pressure was 110—80. There was some evidence of peripheral arteriosclerosis. There was a left-sided hemiplegia involving face and limbs. The muscles of the left arm and leg were in a state of contraction. Neurological examination showed pupils that reacted sluggishly to light and accommodation. The hearing was impaired and there was suggestion of a speech defect. The touch, pain, temperature, tactile discrimination, and stereognostic senses were impaired on the left side. The superficial reflexes were present. No clonus or Babinski. The patellar reflex was active on the right side, absent on the left. Loss of motility of facial muscles on the left side. There was a fine tremor of the extended fingers. The urine, blood ex-

<sup>1</sup> Contribution No. 68, Danvers State Hospital Papers. Presented for publication August 1, 1918.

aminations, and Wassermann tests were negative. For years he had suffered from severe pains in the head, left side of face, and left side of body.

The staff considered the patient's condition, postapoplectic, with some question as to whether the case showed a definite psychosis. Without any apparent illness, except general weakness, and inactivity, the patient died.

Autopsy No. 2047. Pupils are unequal, the right measuring 5 mm., the left 4 mm. The muscles of the left arm and leg are atrophic. Heart is hypertrophied. Coronaries and larger vessels show little sclerosis. There is a stone obliterating the cystic duct. A large perforation is present in the right tympanic membrane. Other organs are not remarkable. There is no lump present on the head now, but in the region of the bregma there are two irregular depressions in the calvarium that may be felt through the scalp. The thumb and index finger fit snugly into these and there is irregular exostosis of bone about them. When the thickened scalp is removed, the eroded areas are plainly seen beneath the intact periosteum. In one of these eroded areas, there is a dark cruor clot. The erosions and the findings within the brain are seen in the accompanying photographs.

*Discussion.*—It is a well-known fact that aneurysms of the aorta may erode ribs or even bodies of vertebræ by the pressure exerted and by the constant hammering that takes place when the force of the heart beat is transmitted to these aneurysms; but so far as we are able to find, no case has ever been reported of erosion of the skull due to an increase in intracranial pressure with a varix of any sinus. Adami (1) says that a familiar instance of bone atrophy from pressure is the depression in the bones of the calvarium due to the Pacchionian bodies. He also states that hydrocephalus and intracranial growths lead to atrophy of the calvarium, but does not cite any cases.

In the first place, we are dealing with a somewhat different condition than arterial aneurysmal erosions. It is difficult to imagine the same amount of pressure and pulsation present in a cavity like the cranium. Bergmann (2) has shown, in a woman with a defective skull, that the brain expands within its cavity synchronously with each cardiac systole. Furthermore, that it expands with expiration due to the pressure in the right side of the heart damming the blood back into the sinuses; while the contrary takes place in inspiration. The brain is unlike the kidney in the latter respect because of the absence of efficient valves in the cranial and vertebral veins, and the continuity of these veins with the right auricle and vena cava. Cramer (3) first recorded the venous pressure and



FIG. 1. Shows the inner surface of the calvarium with the dura attached by firm, thick adhesions that are torn away with difficulty. In the region of the bregma can be seen the varix in the superior sagittal sinus. This varix is 2 cm. in diameter and extends outward through the dura and internal table, to the external table, where it has caused irregular erosion of bone. It will be seen that the sinus opens directly into this, and the varix is lined throughout with the ordinary endothelial coat. When the dura is removed the primary erosion, 2.4 cm. in diameter, is found extending through the internal table into the diploë. At the anterior and posterior edges are seen diverticuli which lead off into the diploic space. Through this opening can be seen the irregularly eroded outer table. The spaces for the meningeal vessels are deeply grooved, and on the left there is a minute erosion through the inner table. In the frontal region, especially on the left side, there are irregular exostoses. There is slight erosion in the region of the internal occipital protuberance. The calvarium as a whole is thinner than usual.

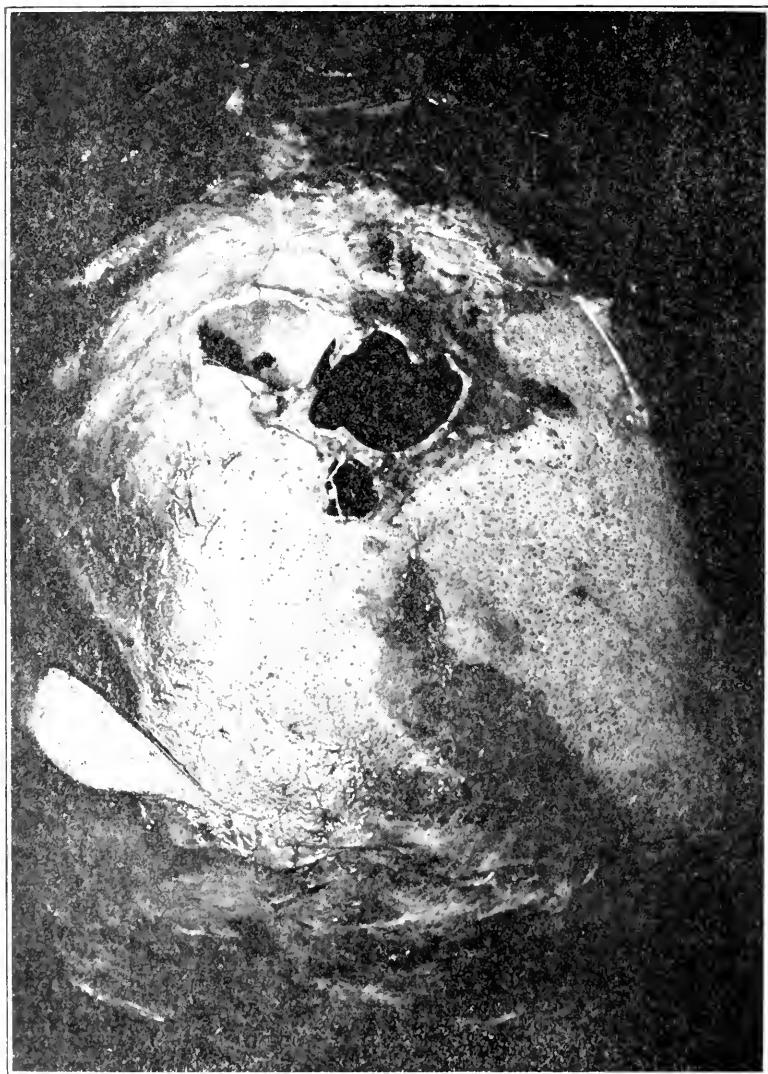


FIG. 2. Shows the erosion of the external table, which is 4 cm. long and irregularly 1.5 cm. in width. There is scar-like exostosis around the edges. There are no areas of softening to be found, and no suggestion of an old cranio-tabes.

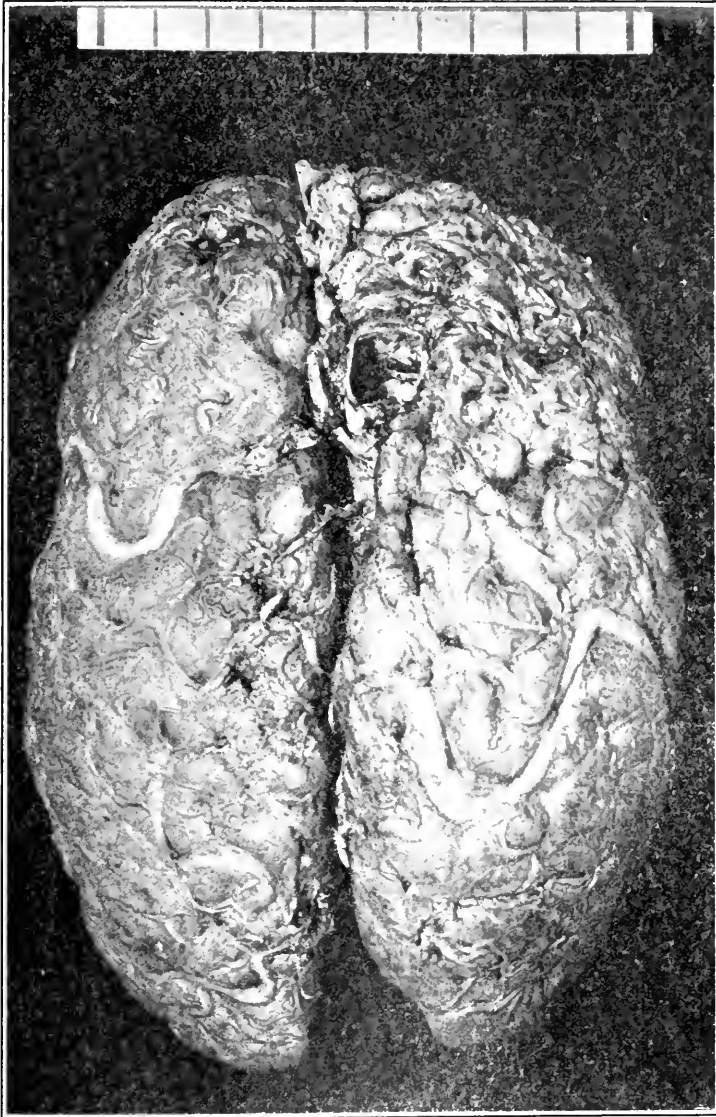


FIG. 3. Shows an opening that was made into a large degenerative cyst in the region of the first and second frontal convolutions of the right hemisphere, when the dura was torn away. The top of this cyst was adherent to the dura just beneath the varix in the superior sagittal sinus, the opening being made when the dura was torn away. The brain tissue within a radius of 4 cm. showed marked softening and a tendency to collapse when the cyst was drained. There are large varicosities in the veins over this area, especially at the tip of the frontal lobe. The veins over the convexity of both hemispheres are greatly dilated and tortuous. The pia is greatly thickened; the capillaries engorged; the sulci shallow and the convolutions indistinct. Brain atrophy is a noticeable feature, especially on the right side.

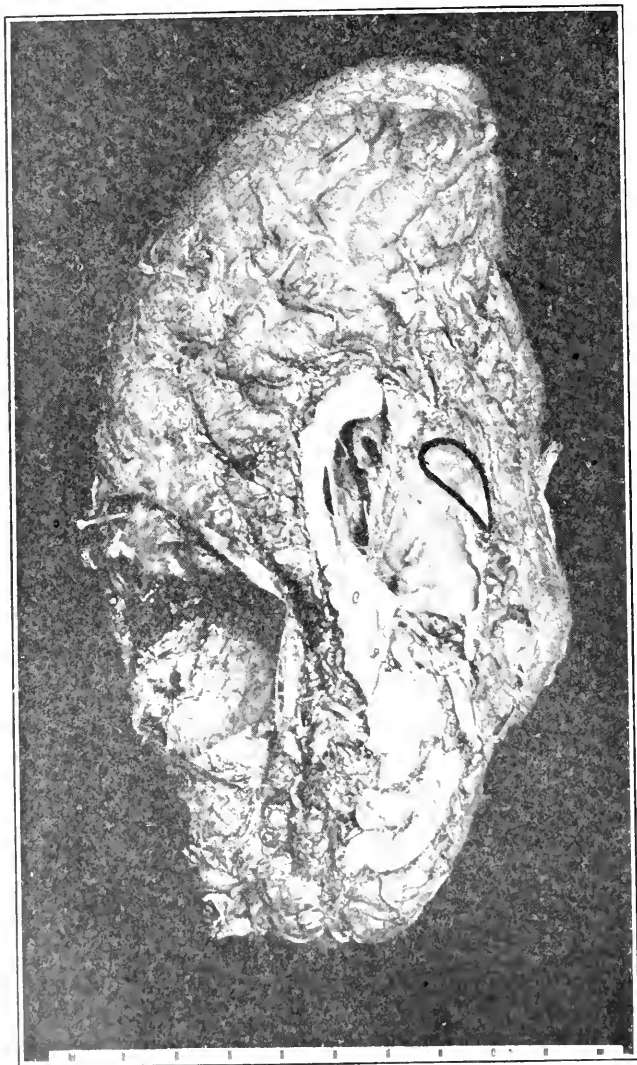


FIG. 4. Shows the right hemisphere after the cyst has been opened. The inner wall of this cyst extends to the septum made by the falx cerebri, with which it is slightly adherent. The walls are formed by a thick fibrous tissue capsule which has been cut and pinned back in order to give a better view of the cavity, which is 4 cm. in diameter. On the tip of the frontal lobe may be seen the vari-  
cosities described above. The india ink line shows the outline of a degenerative cyst, the size of a small olive, in the right cerebral peduncle. This contained a small amount of straw-colored fluid.

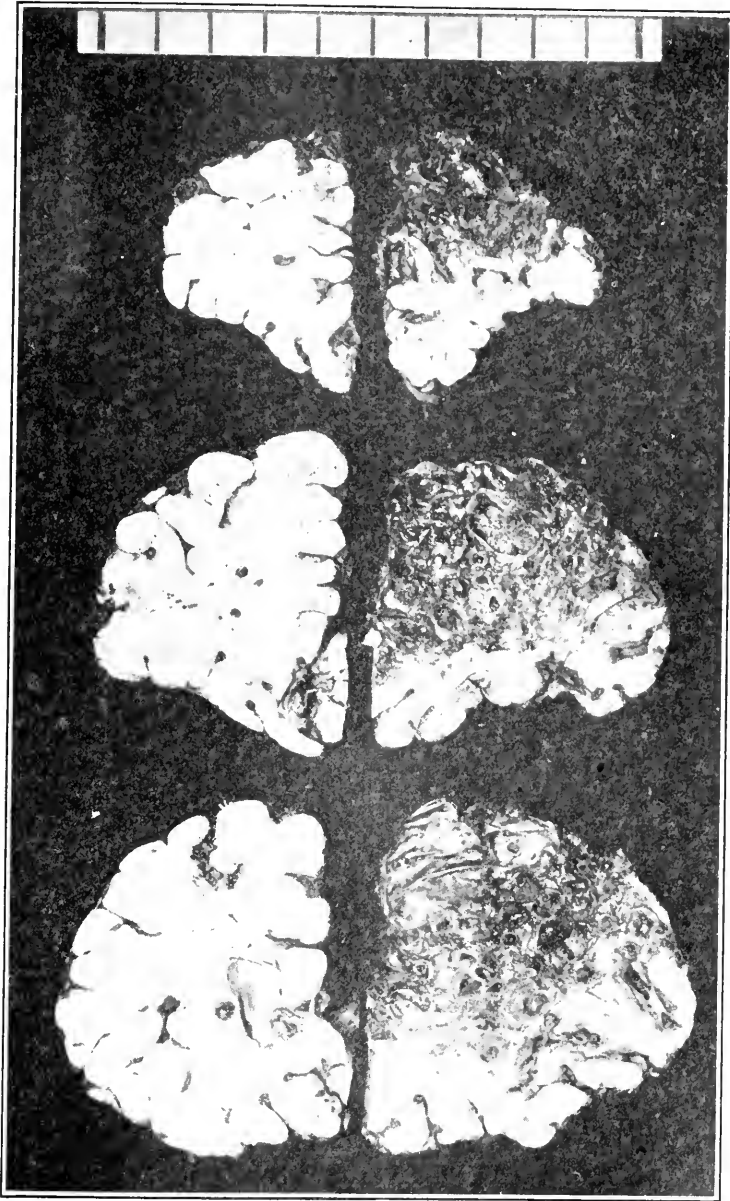


FIG. 5. Shows vertical sections through the frontal lobes, anterior to the cyst. The extensive degeneration of the right hemisphere with the brain substance replaced by a network of dilated vessels is evident.

showed the transmission of the pulse into the transverse sinus. Gaertner and Wagner (4) confirmed this observation. It would seem that the experimental work of Leonard Hill (5) had settled for all time the question of the pressure and pulsations within the cerebral sinuses. By an ingenious method he made simultaneous records of (a) the arterial pressure in the central end of the caroid; (b) the general venous pressure in the right auricle; (c) the cerebral venous pressure in the torcular Herophili; and (d) the cerebrospinal fluid pressure by trephining the atlas. This served to establish the fact that pulsations are transmitted from arteries to the cerebrospinal fluid, the cranial veins and sinuses. He also showed that the brain within its cavity may be likened to a limb or a kidney in the oncometer. The arterial stroke is transmitted to the vessels at the base of the brain and then to the cerebrospinal fluid and venous sinuses. Any increased cerebral tension was found to give proportionate increase in the pulsation within the sinus.

Now, granting that the blood pulsates within a sinus and there is a varix of this sinus due to some weakened condition of its wall, inflammatory in origin; or some congenital defect in the closure of the anterior fontanelle with consequent compensatory varicosity of the sinus to fill this defect, it would be hard to imagine pressure enough under normal conditions to erode bone.

According to different investigators the normal intracranial pressure has been recorded at various points between 50 and 260 mm. of water, which must mean that there are numerous factors affecting its normal range. Since no authorities agree on intracranial pressure, we cannot say what this pressure is normally. Now, to account for the erosion of the skull, in this case, it is necessary to assume that the intracranial pressure rose above the normal limits given. This is the greatest factor involved here, and now we shall attempt to demonstrate its cause.

In this case we do not have to look far to find the cause of the old hemiplegia and the subsequent rise in intracranial pressure. The large cyst containing dark fluid is evidently the remains of an old cerebral hemorrhage nineteen years ago. The thick fibrous capsule shows that it is of long standing, while the dark pigment on its walls, speaks for hemorrhage, rather than embolism or thrombosis. The only record that we have of the blood pressure is more in favor of thrombosis, but what the blood pressure was in his active life is now merely a conjecture.

A consideration of the anatomical arrangement and physical conditions (11) that bear upon intracranial pressure points to the



conclusion that this pressure is controlled by the venous and not the arterial pressure, which is sufficiently confirmed on the experimental side by the investigations of Bayliss and Hill (6). They have shown that a fall in arterial pressure slackens the flow of blood through the brain, while a high blood pressure accentuates it. They believe that intracranial pressure depends not upon the tension of the cerebral arteries, but follows the venous pressure.

Charcot and Bouchard (7) first showed that in many cases of cerebral hemorrhage, there are miliary aneurysms of the small atheromatous arteries in the brain substance, some one of which has burst and allowed the blood to escape. The mid-cerebral, lenticulostriate, or anterior cerebral are most commonly the ones affected, because as Mendel (8) has shown, the blood pressure is higher in these vessels than the smaller vessels of the cortex. Ford Robertson (9) states that pressure in the cerebral capillaries is always higher than in other similar vessels, and that they are provided with a special elastic coat.

Hemorrhage is much more common in men after fifty than in women or younger men, and if we may believe the old dictum of Morgagni, they occur more frequently on the right side. Hemiplegia is apt to be the most striking residual symptom, and in the late cases hemianesthesia may accompany the hemiplegia, which argues for implication of a portion of thalamic fibers. In the early stage the paralysis is flaccid, but may later show pyramidal tract, upper neuron disorder with accentuated knee jerks. This case represents a late stage or mixed syndrome, for the knee jerk was absent on that side and contracture present, suggesting an extension of the lesion into the internal capsule.

When hemorrhage occurs in the brain substance, there will be in the cranium a localized foreign body which occupies the space of a certain vascular area in which function will be lost, because the tissue with which it comes in contact will be more or less completely destroyed. Miles (10) has shown that even minor conditions causing a local pressure may cause mechanical injury to nerve cells. In consequence of the obliteration of the veins and capillaries the local cerebral tension will be raised to that of the arteries which normally feed the affected area. In the obliterated area there is stasis of blood, and in the border areas the capillaries and veins will be compressed in proportion as the increased local cerebral tension is transmitted to the brain substance. The pressure in the cerebral venous sinuses is high so long as there is compression with high cerebro-spinal pressure, even though the systemic blood pressure may be

low. In consequence of this compression, the blood pressure will be raised in these capillaries and veins equal to arterial tension. Robertson (9) states that in such a condition, further expansion of the arteries and capillaries can only take place by an equivalent compression of veins, since the semifluid brain matter is incompressible. The pressure in the brain will then attempt to constrict the veins with their reservoirs of blood until the cerebral venous pressure becomes equal to the intracranial, which is now reckoned as the pressure of the brain against the veins. Now the whole circulatory system of the brain will have assimilated itself to a scheme of rigid tubes. We have in this case an example of such a process manifested by the tremendous engorgement of cerebral veins.

The pathological increase in intracranial pressure may be general or local, the local increase over the general being dependent upon the elasticity of the cerebral tissues, when pressure is produced by blood extravasation, tumors, etc. Hemorrhage into the brain occupies space by force; the surrounding tissues are compressed and stretched and their elasticity maintains a high local pressure. This would account for a primary rise in pressure, but a constant high pressure would need other factors for its maintenance. We have the first of these in the inflammatory reaction that is sure to follow such a hemorrhage. There is a dilatation of vessels, exudation, and finally a walling off of the foreign body, because the large hemorrhage cannot be absorbed. (We have a history of delirium in this case during such a period.)

We now notice that the varix in the superior sagittal sinus lies just above this old area of hemorrhage and inflammation, the dura beneath the varix forming the roof of the cyst which has formed in the hemorrhage area. Therefore it seems logical to conclude that in the inflammatory process the wall of the sinus suffered enough injury to produce this varicosity. Now we are ready to consider another factor which would help maintain a high local pressure. These chronic inflammatory states may easily alter the metabolism in the tissues of such an area, increasing those cell products, crystalloid in nature, which would raise the osmotic pressure, thus causing the tissues to swell and help in maintaining a high local pressure. Hill (5) first showed that the blood pulsates within these sinuses and then showed that the injection of foreign material into the cranium greatly increased the pulsations within the sinuses. So here we have created, by nature, a case which illustrates clinically, the splendid experimental work of that investigator, and in addition shows that in such a rare condition we may assimilate a case of

aortic aneurysm with erosion of ribs or vertebræ. The hemorrhage cyst with the extensive degeneration in adjoining tissues, the cysts in the peduncle and thalamus of that side, the engorged veins, the atrophic brain, the physical signs, the symptoms of a psychosis, and finally the erosion of the skull, all bear witness to the great increase in intracranial pressure which was maintained for years. If we are inclined to be sceptical about the production of the varix, and the primary erosion we might formulate a slight developmental error in the region of the anterior fontanelle with compensatory dilatation of the sinus, but there would be no other evidence of craniotabes to justify such a view, which, were it true, would not account for the extensive, irregular erosion and exostosis of the external table.

#### SUMMARY

1. We present a case that showed a pulsating tumor in the region of the bregma, about the size of a guinea egg, which had been present for nine years before his death. This disappeared after death. A post-apoplectic hemiplegia had been present for nineteen years. He had suffered from very severe headaches for many years.

2. Autopsy revealed a varix of the superior sagittal sinus with extensive erosion of the calvarium above the varix. There were marked changes in the brain substance, shown by atrophy, varicose veins, and degenerative cysts in the cerebral peduncle and thalamus.

3. The varix was probably formed by the inflammatory reaction that followed the cerebral hemorrhage nineteen years ago.

4. Experimental work has shown that the blood pulsates normally within the cerebral venous sinuses. Furthermore, it has been shown that foreign material injected into the cranial cavity increases the strength of the pulsations within the sinuses proportionately to the rise in intracranial pressure.

5. Hemorrhage into the brain occupies space by force. Following such a hemorrhage there is a marked rise in intracranial pressure due to the compression of veins and capillaries; the compression and stretching of brain tissue whose elasticity maintains a high local pressure. The inflammatory and metabolic changes also help in maintaining this pressure.

6. We believe that the pathological findings in the brain prove that a high intracranial pressure has been present for many years, and that the erosion of the calvarium was due to this pressure, both local and general, together with the varix in the superior sagittal sinus.

7. This case would seem to illustrate clinically the experimental work of Leonard Hill and others. It may be taken as an exaggerated example of erosions that are found in the calvarium due to the pressure of Pacchionian granules, or even assimilate a case of aortic aneurysm with erosion of ribs or vertebræ.

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REPORT OF A CASE OF POLIOMYELITIS OF THE  
BULBO-SPINAL TYPE PRESENTING RATHER  
UNUSUAL EYE SYMPTOMS.<sup>1</sup>

BY GEORGE W. HALL, M.D.

CHICAGO

*Clinical History.*—V. S., a girl ten years of age, admitted to the Presbyterian Hospital on September 1, 1917, complaining of headache, coryza, stiffness of the neck. Her father states that five days previous, while at her summer home in northern Michigan, the patient complained of severe headache, which increased in intensity. At that time the temperature registered 99.8° F. On the second day the temperature rose to 101° F., the patient becoming more restless. It was thought by the physician in charge that she had probably contracted epidemic meningitis and he recommended that she be taken to the hospital for further study and treatment.

Examination on entrance to the hospital showed that she had a convergent strabismus of the right eye and complained of seeing double. The neck was rigid, the nasal mucous membrane congested. The throat was negative and vision and hearing was normal. Chest normal, abdominal reflexes present and normal.

Upper extremities showed a good grip in both hands and reflexes in upper extremities were normal. The lower extremities showed exaggerated knee jerks; right leg was slightly rigid and Babinski sign positive on the right side. No sensory disturbances.

Previous history: Had diseases of childhood. Family history: Father and mother healthy, one brother and one sister living and well.

September 8, 1917: Examination showed a slight paresis right seventh nerve, a diplopia, exaggerated right patellar reflex, slight ankle clonus on same side, Babinski sign present on right side. Left foot was normal. Temperature 100.3° F. Horizontal nystagmus present.

September 17, 1917: Both optic discs were examined by Dr. E. V. L. Brown and pronounced normal. Convergent strabismus of right eye present.

September 20, 1917: The patient complained of blurred vision in right eye. The eyes were examined again by Dr. Brown and the findings were as follows: Neuro-retinitis 5½ D. with an edema of adjacent retina for 2 or 3 P.D., no hemorrhage or exudative "flicks." She is

<sup>1</sup> Chicago Neurological Society, March, 1918.

able to see one's fingers at a distance of twelve feet with right eye; left eye normal.

September 22, 1917: Examination of the nose by Dr. G. Sluder of St. Louis revealed a low grade post-ethmoidal sphenoiditis, more marked on the right side, mildly acute. The right disc showed no increase in the retinal edema and measured 4 D. only. No hemorrhages or exudate.

September 24, 1917: The swelling was reduced to  $\frac{1}{2}$  of 1 D. Vision much improved. She is able to read print 2 mm. high.

September 26, 1917: The eye showed continued improvement.

October 2, 1917: The patient complains of deafness in the right ear. She can hear the whisper of 66 at one foot and 18 at two feet. Left ear normal.

October 3, 1917: The patient holds her head to the left side; horizontal nystagmus still present, rapid component to the left. Vision clearer.

Examination of the blood: September 2: Leucocytes—26,250. Hemoglobin—80 per cent. 9/10/17, 21,950; 9/26/17, 14,350; 10/4/17, 13,150.

Examination of the urine: Specific gravity 1.020. Trace of albumin and a few epithelial cells.

Examination of the spinal fluid: September 1, 1917: Clear under pressure, cells 71 lymphocytes, no organisms present, reaction for globulin positive. Wassermann negative.

Lange reaction was as follows:

Tubes 1—2—3—4—5—6—7—8—9—10.

Reaction: 3—4—4—3—2—2—2—2—2—1.

September 13, 1917: Lymphocytes 34; Nonne reaction positive.

On October 3 the temperature registered 99.8° F. She was then removed to her home in St. Louis where she made a gradual and complete recovery. The illness extended over a period of about ten weeks.

The diagnosis of poliomyelitis of the bulbo-spinal type was made owing to the focal symptoms present, such as strabismus, facial paresis of the right side, deafness in right ear, disturbance of vision in right eye, presence of nystagmus, Babinski right side, etc., and the decidedly increased cell count in the spinal fluid. I report this case especially because of the eye findings; similar conditions have been reported in only a few cases.

I am indebted to Drs. Brennemann and Gill, with whom I studied this case, for the privilege of making this report.

## THREE UNUSUAL NASAL (SPHENOPALATINE) GANGLION CASES<sup>1</sup>

BY GREENFIELD SLUDER, M.D.

ST. LOUIS

In 1908<sup>2</sup> I described the symptom-complex that seemed referable to the nasal ganglion. Since that time, I have added some features under the headings of motor, sensory, gustatory and sympathetic.<sup>3</sup>

The pain picture is by far the most frequent and predominant and next to that, I believe, come manifestations that seem referable to the sympathetic nervous elements of the ganglion.

It will be recalled that the nasal ganglion, that is, the sphenopalatine or Meckel's ganglion, is supplied from the maxillary, with the sensory fibers and by the Vidian nerve, with fibers from the geniculate ganglion of the seventh and the carotid plexus of the sympathetic.

This has been a very interesting phase of practice to me and to-day I report three cases each having, it seems to me, unusual features. They do not belong as representatives of types of cases.

The usual neuralgic picture is pain in and about the eyes and the upper jaw, the teeth, extending backward about the temple under the zygoma into the ear, making earache; and then backward into the mastoid; and severest usually at a point two inches back of the mastoid, to extend into the occiput, the neck, the shoulder; into the shoulder blade and sometimes the axilla and breast and frequently down into the arm, forearm, hand and even to the finger tips.

Added to this symptom-complex frequently is found a sneezing and watery secretion, more marked probably in the morning, frequently extending through the day; a red external nose, with tearing eyes, photophobia and a sense of discomfort in the eyes, difficult for the patient to describe.

Occasionally, however, are added unusual features to this clin-

<sup>1</sup> Chicago Neurological Society, March, 1918.

<sup>2</sup> Greenfield Sluder, The Rôle of the Sphenopalatine or Meckel's Ganglion in Nasal Headaches. New York Medical Journal, May 23, 1908.

<sup>3</sup> Idem. The Sympathetic Syndrome of Sphenopalatine (Nasal) Ganglion Neurosis, Together With a Consideration of the Neuralgic Syndrome and Their Treatment. Trans. American Laryngological Association, 1915.

ical complex. These cases record phenomena that at present are unique and cannot be explained. They may be recorded as facts.

MRS. C. F., thirty-five years old, consulted me January 1, 1918, at the suggestion of Dr. Fayette Ewing. She had suffered violently from headache a large part of her life. Dr. Ewing had found some disease of the ethmoid on the left side and had curretted the capsule of the ethmoid for that reason. She continued to have great headache and as he was about to depart for service in the National Army, he put her in my charge. In the effort to localize some starting point for the pain, I cocaineized the ganglion of the right side at the time when the headache was on the right side. The headache stopped; but as an effect of cocaineization the right eyelid drooped very perceptibly to obscure probably half of the blepharal fissure and the pupil contracted to one half of the size of the fellow of the opposite side.

The case presents this interesting phenomenon: That through the nasal ganglion in this case must pass a large part of the sympathetic supply which goes for the elevation of the eyelid and to the pupil. Further experiment, when the pain was on the left side, showed that cocaineization of the left ganglion failed to control it, but that it (pain) did stop from cocaineization of the right ganglion.

MRS. H. C., thirty-five years old, Joplin, Mo., consulted me December 15, 1917, complaining of great lower-half headaches, right and left, accompanied by dizziness—"the objects went around her"—of such severity that she was able to walk only with difficulty. She had suffered eight years from these conditions. Examination revealed a well-marked post-ethmoidal-sphenoiditis, with considerable acute element mixed with it. In the effort to localize the point from which the pain proceeded, cocaineization of the ganglion was followed by cessation of the headache, with almost instantaneous relief of the dizziness. After six hours the headache returned to some extent, but the dizziness was almost absent. Owing to this patient living at a distance, further observation has so far been impossible.

This patient had been carefully investigated in every department of a general examination. This case is of interest, showing dizziness of rotatory type stopped by cocaineization of the nasal ganglion.

MR. F. B., aged thirty-eight, consulted me November 1, 1917, sent by Dr. F. L. Henderson, who had exhausted all means known to him for the relief of a right-sided blepharospasm of great severity. Examination showed a post-ethmoidal-sphenoidal suppuration, with polyps on the right side. Experiment showed that cocaineization of the right nasal ganglion opened his right eye and relieved the blepharospasm for a period of three hours.



It was therefore decided to inject<sup>2</sup> the nasal ganglion of the right side. This was done three times and was followed by relief of the spasm for three to six hours at each injection.

The right post-ethmoidal sphenoidal operation was performed December 21, 1917, and also relieved the spasm for a few hours. Treatment of the sphenoid cavity was followed by the cessation of the sup-puration and disappearance of the polyps; but the blepharospasm remained. Right intrasphenoidal cocainization relieved the spasm for three to six hours.

The case was unsatisfactory, at least for the blepharospasm, and I determined to open the sphenoidal cavity of the left side, which, in the nose, appeared to be normal. I decided on this because I remembered that nobody could tell the subdivision of the sphenoidal body prior to opening it, and not always then, without X-ray plates with probes in situ. I felt that the irritation might come from the left sphenoidal sinus.

Prior to this the experiment with the left nasal ganglion was performed and was found to give longer relief from the spasm than had the right nasal ganglion or the right sphenoidal sinus operation. I then elected to inject the left nasal ganglion. This has been done twice with transitory relief. On April 20, 1918, I opened the left post-ethmoidal cells. The blepharospasm is unchanged.

This case is exceedingly interesting, bringing up the question of the path of the impulse which may set off the blepharospasm.

I had assumed that it was sent through the great superficial petrosal from somewhere—the seventh nerve possibly or the geniculate ganglion—but that it would be of the same side. The fact that the injection of the left ganglion opened the right eye is, to my mind, not to be explained at present.

<sup>2</sup>Idem. A Phenol (Carbolic Acid) Injection Treatment for Sphenopalatine Ganglion Neuralgia. *Jour. A. M. A.*, Dec. 30, 1911, p. 2137.

## NON-SPECIFIC POSTERIOR COLUMN LESIONS<sup>1</sup>

BY OTTO G. FREYERMUTH, M.D.

SAN FRANCISCO, CAL.

In discussing lesions of the posterior columns of the spinal cord, one is too prone to consider the diagnosis of tabes with its luetic involvement. It is the object of this paper to illustrate this too common error as made by the general practitioner.

Briefly stated, the spinal cord is composed of various nerve tracts. The descending—with the exception of Löwenthal's tract—are motor in function; the ascending are sensory. The arrangement of the tracts surrounding the central gray matter is quite uniform, though the demarcation of the several tracts is arbitrary and indistinct since the fibers of the contiguous tracts intermingle somewhat.

Likewise, the vascular system of the cord is divided, generally speaking, into three sections—(1) the superficial area comprising most of the white matter supplied by the centripetal group of arteries and formed by the anterior and the posterior spinal arteries; (2) the central area comprising most of the gray and fragments of white matter; supplied by the centrifugal group of arteries and formed from the anterior spinal artery; (3) the intermediate area formed of those areas of gray and white matter not heretofore included and which are supplied by branches from both the anterior and the posterior spinal arteries. We may further grossly delineate the cord into a posterior area of only white matter and supplied by the posterior spinal artery and an anterior area comprising both white and gray matter and supplied by the anterior spinal artery. It is interesting to note the arrangement of the posterior branches as they leave the mother stem and penetrate the substance of the cord at a nearly right angle—making a sharp curve which obviously contributes to the vascular disturbances and the resulting neuropathology.

There is as yet no definite evidence as to how much sensation—pain and tactile—is conducted by the columns of Goll and Burdach nor how they relatively compare with the spinothalamic tracts in such conduction; all such impulses are conducted exclusively by

<sup>1</sup> Read before Section Nervous and Mental Diseases, Chicago, June, 1918.

these columns while the spinothalamic tract alone is presumed to transmit thermic impulses. In addition to the conduction of pain and touch impulses, the posterior median columns, in common with the posterior spinocerebellar columns, transmit joint and muscular sense whereby coördinate action is maintained.<sup>2</sup>

Diffuse lesions of the spinal cord result in a more or less extensive myelitis. I do not believe that myelitis is ever primary. Lesions may be either extramedullary or intramedullary, producing symptoms which are either of slow or of rapid onset. When of slow onset, a neoplasm or a gradually extending ischemia due to arterial occlusion is the disturbing factor, while a hemorrhage, an embolus or a thrombosis produce symptoms of a rapid occurrence. An autochthonous coagulation of the spinal arteries is indeed rare. Neoplasms of the various types are more frequent. Vascular disturbances will be considered presently.

The location of the cord lesion determines characteristic symptoms, the detailed description of which is familiar to the neurologist. Grossly speaking, lesions in the anterior cord produce motor symptoms, while those of the posterior cord result in sensory phenomena. The anterior spinal artery when involved invariably effects the anterior gray matter resulting in immediate loss of function of more or less intensity. The posterior arteries however attack the posterior white matter—the columns of Goll, of Burdach and the direct cerebellar tracts. Gower's tract often escapes, preserving the spinothalamic tract and thus maintaining more or less sensory conduction.

It is to these posterior columns that attention is directed. The pathology of *tabes dorsalis* involves the posterior root system—the posterior columns, the posterior root and its ganglion, the tract degeneration resulting secondary to the root involvement—the result of luetic infection. In degeneration of the columns due to lesions per se, the posterior roots are not involved unless by extension of the existing lesion. Various pathological processes may involve the posterior columns; this paper will confine itself to vascular lesions, of which hemorrhage is the most frequent, embolism very rare and thrombosis exceedingly infrequent. It is not essential to dwell upon detailed statistics. Hematomyelia fortunately is uncommon, quite a contrast to the comparatively frequent hemorrhages of cerebral situation. Of those that do occur, however, 90 per cent. are attributed to traumatism as the exciting agent. Such traumatism may result from obstetrical manipulation, convulsions, certain forcible body twists, jars, during cataleptic attacks, etc., 10 per

<sup>2</sup> See Jelliffe and White, *Diseases of Nervous System*, 2d edit.

cent are due to predisposing hematogenous conditions, such as may be found in typhoid, morbus maculosus Werlhoffi, diphtheria, certain debilitating diseases and anemia—secondary and pernicious. Spontaneous hematomyelia may be an exception. The gray substance of the cord is usually the seat of the lesion.

Pernicious or very severe secondary anemia invariably involve the posterior white substance, the gray matter rarely being impinged upon. Just why this condition should be is problematical. Cannot it be due to the physical condition of the artery in leaving the parent stem and penetrating the white matter at a right angle, thereby producing a weakness in its wall which may result from the anemic condition? Or is it due to toxic action concomitant with the morphological blood conditions? If this hypothesis is accepted, then why should not the capsular arteries be the point of election? These are problems yet to be solved and no doubt with the improvement of laboratory technique these obscurities will gradually though certainly disappear.

Of the vascular changes affecting the posterior columns, embolism, thrombosis and autochthonous occlusion should only be considered when the diagnosis of hemorrhage can not be determined.

The symptoms of hemorrhage into the posterior columns—excepting the rapid onset—are very akin to those of tabes dorsalis; should the pyramidal tracts be encroached upon, symptoms of combined sclerosis would follow.

The case here presented will illustrate the subject of this paper.

CASE 2561. F. P., male; age 39 married; occupation traffic clerk.

*Complaint.*—Unable to walk. Mental confusion.

*Family History.*—Aside from the statement that the father died at 52 from diabetes, nothing of the paternal side of the family is ascertainable. The mother died as the result of a Cesarean section—the patient was the babe—nothing more is learned of the mother's family.

There were no brothers. A half sister of whom he knows nothing is the only kin he has. His wife is a rather frail woman though apparently healthy, with a clear history of no abortions or miscarriages. Has one son aged nine who likewise is underdeveloped though not an invalid.

*Past History.*—Born in Massachusetts. As an infant was a sickly babe, illy nourished and marasmic. Later he developed most of the diseases incident to childhood—rubeola, pertussis, parotitis, scarlatina, varicella and more or less gastro-intestinal disturbance. When 10 years old, he was severely burned on the side, the scar of which he still distinctly shows. At 14, he was bitten by a dog, from the effects of which he suffered over a year; at this time some kind of a serum treatment

was administered for his condition. Immediately following this treatment, a blood dyscrasia developed as evidenced by a furunculosis which remained with him with more or less exacerbation till the present. From his youth to the present he had never been sufficiently ill to confine him to bed, though he had not at any time been real well. His appetite was always good; the urinary organs functionated quite normally but the bowels remained persistently obstinate. Slept well but seldom was refreshed after a night's slumber. Any sustained effort was not tolerated on account of the fatigue which developed upon any effort. His memory was good and mind always seemed clear.

*Present History.*—About seven months ago while at his work, he suddenly "blew up," as he states it. He became nervous, irritable and unable to adequately perform his duties. His physician gave him electrical treatments. After two months following a treatment, he suddenly became "shocked" as he terms it, by an overcharge(?) of electricity, for his both upper limbs became numb, succeeded in a few days by numbness in the lower extremities. This remained but a short time and disappeared, leaving the lower extremities weaker than before. He continued in this condition till two months ago (five months after the onset), when he suddenly lost control of his lower limbs and could not walk or stand. There was no change in the urinary condition nor of the bowels. He had no pains nor constricting paresthesia. In a few weeks he was sent to a hospital in San Francisco for treatment and observation, where he remained for five weeks, when symptoms of mental confusion developed. He was then sent to the detention hospital with the diagnosis of locomotor ataxia and insanity. It was at this time that I first saw the patient.

He was mentally confused—disoriented as to time and place, so much so that it was impossible to proceed with the history and the subjective symptoms till a few days later, he having in the interim been removed to a hospital for observation. His complexion indicated a pronounced blood impoverishment; the skin was sallow and of a murky color pitted profusely with furuncle cicatrices. Apparent age about 50 years; weight 126 lbs.; height 5 ft. 11 inches; chest expansion 36 to 37½ inches; the skin lay in loose folds over the flabby muscles. The thenar eminences as well as the peronei muscles were noticeably atrophied. Eyes gray; hair gray; facies apathetic. The spine was slightly forward bent.

The heart slightly enlarged with a definite systolic murmur heard most distinctly at the tricuspid area. The lungs were quite normal as to area and sounds, though the respirations were rather shallow. The stomach was rather distended; the intestines tympanitic on the right, dull on the left. Liver, spleen, kidneys, bladder and prostate seemed normal on percussion and palpation. There was no arterio-sclerosis nor atheroma. Pulse 68; temperature 97; respirations 20. Blood pressure—systolic 98; diastolic 62; pulse pressure 36.

*Sensory Tests.*—To cotton wool and to thermic, he was normal in all

segments. To pin prick, he was normal down to the 12 D segment and for the remainder of the segments very much diminished, on both sides. Both tendo Achilles and testicles were sensitive to pressure. No pronounced tremor in either upper or lower extremities. Pallesthesia and topognosis were present in the upper but much diminished in the lower limbs. The deep joint and muscle sense present in upper, absent in lower; stereognosis somewhat affected in the lower; diadokokinesia present in upper and lower.

*Coördination tests* were defective in the upper, impossible in the lower. Electrical reactions not involved.

*Motor.*—The muscles are flabby and atrophied, possibly from disuse—the skin lying over the muscles and subcutaneous bone in loose folds. The muscles were likewise pronouncedly hypotonic, more so in the lower. There was a fair amount of strength in the fingers and wrists, a little less in the remaining portion of the upper extremities and the trunk muscles, while the thighs, legs, feet and toes were very weak—in fact movements of these areas were executed with difficulty.

*Reflexes.*—The triceps, biceps, supinator longus, wrist, finger bogen, cervical sympathetic, corneal, are normal on both sides; the chin normal; the epigastric, abdominal and hypogastric quite diminished on both sides; the cremasteric both absent; both patellars pronouncedly increased; patellar clonus present on the right, a trace on the left; the ankle jerk and clonus absent on both sides. The plantar reflexes to Babinski, Oppenheim, Chaddock and Gordon are down, viz., normal.

*Cranial Nerves.*—1st, smell normal both sides; no anosmia or parosmia.

2d, vision 20/20; the range as temporal, superior, nasal and inferior fields unaffected; color range for red and green normal; both discs are distinct and vessels clear; the fundus aside from unusual paleness, is normal.

3d, 4th, and 6th, no nystagmus in either eye; movements are sustained; pupils are equal, central but a trifle irregular; reaction to light in both is regular and rapid, direct and consensual; on convergence they react likewise. There is no diplopia. The general appearance of the eyes is dull with expressions of fatigue.

5th, motor somewhat weak, taste is accurate; teeth are poor—many cavities and evidence of pyorrhea.

7th, face is symmetrical and all muscle movements are intact, though a little weak; no involvement of taste or hearing. The facial expression is rather apathetic. 8th, range on right is  $1/12$ , on left  $1/6$ . Rinne and Weber normal.

9th, pharyngeal muscle movements are normal; pharynx is pale; swallowing unaffected.

10th and 11th normal.

12th, tongue clean, somewhat pale, protrudes without deviation; pronounced tremor.

*Abnormal Movements.*—Not able to walk; lower limbs movable but ataxic.

*Witness.*—Uncertain in some respects; as a whole however, a fair history is obtained at different interviews and with assistance of his wife.

*Cerebration.*—Not clear; at times confused with interspersions of hallucinations, illusions and delusions. A definite hypnesia (delayed thought).

*Speech.*—A noticeable, hesitancy suggesting an impediment. Tendency toward dysarthria. There is no scanning.

*Laboratory Findings.*—Blood. Wassermann and Noguchi are negative. Leucocytes 5,000; erythrocytes, 2,500,000; hemoglobin 65 per cent.; color index, 1.3. Differential. Polymorphonuclears, 56 per cent.; large lymphocytes, 8 per cent.; small lymphocytes, 32 per cent.; large mononuclears, 3 per cent.; eosinophiles, 0 per cent.; mast cells, 1 per cent.; myelocytes, 0 per cent. There are numerous poikilocytes; a few megaloblasts and microcytes; several stippled cells. Spinal fluid. Pressure slightly diminished; is clear; negative Wassermann and Noguchi; colloidal gold, negative; globulin, negative; cell count 11.

Albumin present due to large amount of pus, indicating an existing cystitis; indican in excess; no casts or renal epithelium; sugar absent.

*Diagnosis.*—Hemorrhage into the posterior columns of the cord at the 12th D segment, involving the lumbar and upper sacral segments; anemia, in all probability secondary, developing into the pernicious type.

*Prognosis.*—Guarded. Improvement in the blood and of the paralytic condition will undoubtedly occur under intensive treatment, but there is always the tendency for recurrence of the hemorrhage.

*Treatment.*—Intensive constructive medication, preferably the intravenous method. Cacodylate of iron and of soda; the calcium salts; mild laxative. Educational exercises should be daily encouraged.

*Remarks.*—This case illustrates how readily posterior column lesions may be mistaken for posterior root and column lesions of tabes. Even without the serological report, the sudden appearance of the symptoms, the absence of the insidious root pains, the sensory findings and the condition of the deep reflexes should be the guiding data directing the attention to the posterior columns.

## Society Proceedings

### NEW YORK NEUROLOGICAL SOCIETY

THREE HUNDRED AND SIXTY-SIXTH REGULAR MEETING, TUESDAY,  
OCTOBER, 1918

The President, Dr. FREDERICK TILNEY, in the Chair

#### PARESIS AND INTRAVENTRICULAR TREATMENT

Dr. I. J. Sands, of New York, showed the brain of a paretic who had evidenced all the clinical signs of the disease and had been sent to the Manhattan State Hospital as incurable, previously having received one intraventricular injection of arsenphenolamin. The pathological condition presented at autopsy spoke eloquently against this form of therapy, for the amount of inflammatory reaction, characteristic of paresis, was far in excess of the normal quantity. In the opinion of the speaker, the results of intraventricular injection of salvarsan did not warrant treatment in this manner and he believed the patient would have had a fairer chance of improvement through intravenous injection of the drug.

Dr. F. Tilney said that at one of the meetings of this society last spring a number of paretics were presented by Dr. Norman Sharpe, they then being under treatment by intraventricular injection of arsenphenolamin, and several opinions were expressed concerning their improvement, or alleged improvement. There was no pathological criterion in these cases by which one could be guided. As far as the speaker was aware, this brain shown by Dr. Sands was the first that had been exhibited after this form of therapy had been employed, and it would be of interest in the light of such pathological evidence to hear the subject discussed further.

Dr. B. Sachs, of New York, said he had no desire to discuss the whole subject of the treatment of paresis by intraventricular injection of salvarsan, but there was a question in his mind regarding this brain and that was, could it be regarded as typical of general paresis or had the patient really suffered from meningoencephalitis specifica. This excess of exudate did not seem typical of true paresis, but it was just this type of case which gave rise to paretic symptoms. As the speaker understood Dr. Sands, the symptoms appeared fairly early after the



initial infection. If this was so, the case was a very interesting one on that account.

Dr. Sands said there was every reason to believe the case one of general paresis, from the clinical evidence the man presented. At autopsy they found a lymphoid and plasma cell infiltration about the vessels and within the pia; also there was cortical disorganization, and the granulation of the ventricle was quite noticeable. This case was not of the meningoencephalitis specifica type. Regarding Dr. Sachs's statement about the milky exudate, one of the observations frequently made at the Manhattan State Hospital was the milky exudate usually found in the anterior two thirds of the brain. It might not be a continuous process, it might be only in patches, but it was always found.

### FEEBLEMINDED PROBLEM

Dr. Walter B. James read this paper. In introducing Dr. James Dr. F. Tilney said that doubtless many remembered when the Act of Mental Deficiency was up before the House of Commons in 1913, how it met with a good deal of opposition and required a good deal of defense. The most telling argument made in its behalf was a statement that a new charter of liberty was being secured for a group of persons heretofore deprived of their rights. This country was very much behind England in that respect and yet a movement in this direction was growing every year. New York was perhaps the leader in it and particularly of late, in consequence of the appointment of a special commission in this State to deal with the problems of the feeble-minded, and to which Dr. Walter B. James had been called as chairman. This was a long step in advance, and Doctor Tilney felt the society was very fortunate in having him there to explain how the neurologists could be of assistance in furthering this important movement.

Dr. Walter B. James, of New York, then said: When your president, Dr. Tilney, invited me to open this discussion on the problem of the feeble-minded I was glad to accept, because I realize that the solution of this difficult problem is much more apt to be found if we can have the sympathy and coöperation of the members of this distinguished society. The Neurological Society has always stood for all that is best in its department of medicine, both as far as neurology is concerned and in its relation to the public health and welfare.

Although I realize how active and interested a part your society has always taken in public discussions of matters connected with neurology and psychiatry, nevertheless, because I know how easy it is for busy physicians to fail to follow the many things that are done in Albany, therefore I am going to take the liberty of stating the present situation of the question of the feeble-minded as far as its relation to the State government is concerned.

It is almost two years since the legislature, impressed with the over-

crowded condition of the State hospitals for the insane and by the general incoördinated and more or less unsatisfactory relation of the institutions for the feeble-minded to the State government, created the State Hospital Development Commission, whose duty it became to study and report upon all of these institutions and the care of the insane and the feeble-minded, with recommendations for such measures as might be needed in the interest of both groups of unfortunates. In the course of its investigations, the commission became convinced that the institutions for the feeble-minded suffered in that they were not coördinated under a single control commission, as in the case with the hospitals for the insane. I had the honor of being one of the governor's two appointees on the Development Commission, and I was much impressed with this state of affairs.

Accordingly the commission recommended that the legislature create a new and separate body to care for the institutions for the feeble-minded, and this was done last April, when the State Commission for the Feeble-minded was created by act of legislature. There had been previously, many legislative committees to study and report upon this subject, and recommendations had been made and certain voluminous reports had been published, but until this time no concrete action had been taken, looking to the actual remedying of these difficulties.

Realizing the inadvisability of creating any new salaried positions that could possibly be dispensed with, it was decided that the makeup of the new commission should consist of a chairman who should be a physician who had had at least ten years of actual practice of his profession, and that the other two members of the commission should consist of the secretary of the State Board of Charities and the fiscal supervisor, both of whom were already receiving salaries in their respective positions, and both of whom were officially in close relation with the four institutions for the care of the feeble-minded.

The commission was charged with the duty of administering all laws that have to do with the feeble-minded, of planning a census, and of keeping a record of all persons in the State who are feeble-minded, of estimating the capacity of the institutions for the feeble-minded in the State, of inquiring into and establishing colonies and clinics in connection with the institutions, making rules for the reception, treatment and training, discharge, and transfer of inmates, and of making recommendations for such new institutions as might be needed. The commission was also commanded to draw up and present to the legislature a commitment law for the feeble-minded. The commission is intended to be a permanent one, and to coincide closely in its duties and powers with the State Commission for the Insane.

The commission came into existence on July 1, 1918, and began at once to study all of the institutions and other State activities that are maintained for the benefit of the feeble-minded. As you all know, there are a good many agencies throughout the State which have to do with

these patients. There are four asylums in which they are maintained and which accommodate about 4,000, not including the city institution at Randall's Island. Then there are the ungraded classes in the public schools and the clinics that are being held in various parts of the State and connected sometimes with universities or with hospitals, and in many cases with the courts, and all individually doing good work. Then there are large numbers of mentally defective persons who are located in jails, penitentiaries, reformatories, training schools, and county almshouses, and one of the most important functions of the commission will be to try to correlate these various groups of persons and to bring their diagnosis, study, and management into close relation, in order especially to avoid the expense of duplicating agencies for doing the same kind of work. Then there are training schools needed in the institutions for the feeble-minded for the purpose of educating attendants and especially teachers for the ungraded classes in the public schools.

But there is a whole group of questions that arise, for answers to which we must turn to the medical profession. There is the great and burning question of the differentiation between primary and secondary mental defectiveness, which in the light of Weismann's law—that acquired characters are not transmitted—becomes so acutely important in relation to the question of sterilization and the prevention of child bearing. It is perfectly evident that if the question of child bearing could be definitely disposed of, many of the most trying difficulties would drop away from the problem itself. Newark, with its 800 or 900 women of child-bearing age, segregated there for the purpose of preventing them from procreating, always gives one food for very serious thought. In addition there are many questions as to what type and what degree of education or training can be advantageously applied to these persons and at what age it is best to begin.

There is also the great question of the delinquent feeble-minded, whom we find in such considerable numbers in every reformatory and prison. The very valuable work of Dr. Bernard Gluck has pointed this out very vividly in connection with Sing Sing Prison. The recent brilliant work by Doctors Fernald, Southard, and Taft, of Boston—*Waverley Researches in the Pathology of the Feeble-minded*—a memoir presented to the American Academy of Arts and Sciences, in May of last year, throws much light upon the brain conditions of mental defectives and opens up a fascinating line of inquiry into the relation between primary and secondary amentia with all the questions that have to do with procreation and eugenics.

The work of Dr. Bernstein, of the Rome Custodial Asylum, in establishing colonies where these unfortunates can live a life that seems to be about midway between a normal happy home life and the dreariness of a large institution, suggests the possibility that ways might be found for utilizing, for the public good, the large human asset which is shut up in our various institutions, a detriment to the individuals themselves

and a loss in labor to the community. This of course applies only to the moron group. This work is still in the experimental stage, but certainly justifies further careful trial.

The Lockwood bill, a recent law which requires that whenever in any school there are as many as ten pupils who are as much as three years behind in their studies, they shall be formed into a special class with a special type of teacher, is one distinct step in advance in the mental hygiene of our Empire State.

The Prison Commission is inquiring into the matter of the feeble-minded delinquents, and various private committees are doing helpful work by their investigations, so that, altogether, the subject of the feeble-minded today is occupying quite a good deal of public attention and offers a fascinating field of inquiry; and probably there are few others in which there is so much to be done in the way of human betterment through careful study of conditions and possibilities from the point of view of modern medical science.

The field of research in mental defectiveness has hardly been touched in our country. The work above referred to from Waverley, gives promise of stimulating further work that is sure to be productive of good results.

This war, in which we are so intensively engaged, and the imperative need of maintaining a maximum of efficiency in our armies, has made it imperative that all mentally affected be weeded out of them. This mental defectiveness and mental disease have become an acute army question, and an immense organization had to be developed to seek out, understand, and treat these cases. Much useful knowledge will doubtless be obtained in this way, and it is to be hoped that more young medical men will be stimulated to devote themselves to this fascinating and modern branch of medicine. It is likely also that at the conclusion of the war a large number of able young men skilled in psychiatry will be turned back into civil life to occupy their time, attention, and energies with the many problems thus presented.

I am quite aware that I have succeeded in outlining, only very briefly, our problem and the steps the State has taken to attempt a solution of it, steps toward which a large number of social and other agencies have looked with much eagerness for a long time. I have not attempted to show how we expect to meet it, for necessarily our plans are still only in the formative stage, our commission being in existence only three months as yet; but we have an office established here in New York City where active work is already being done.

There are other and difficult questions constantly arising, and on these we shall ask the advice of the profession. For instance: What is to be the ultimate fate of the feeble-minded of New York City. Are they to continue to be cared for by the city, on Randall's Island, or should they be brought under State control as was done successfully with the city's insane a good many years ago? There is no doubt that conditions upon

Randall's Island leave much to be desired, but these are questions that can be settled only after careful study and much serious thought.

This then, gentlemen, is the situation and these are the problems, and this is why the commission is so glad to turn to the medical profession and to ask for its earnest aid in its important and difficult task.

*Discussion.*—Dr. C. L. Dana expressed his great confidence in the work which Dr. James, as chairman of the new State Commission, was going to do and hoped that the society would give him every support. Naturally, the neurologists and other medical men were very strongly in favor of the view that the study and care of the feeble-minded was fundamentally a medical consideration to which every possible allied science and art should contribute help. Statistics showed that in clinics for the feeble-minded there was a very marked percentage of physical disease as well as actual mental disease. A survey of the history of the present activities on behalf of the feeble-minded showed that there had been two somewhat antagonistic schools, one which rather gave emphasis to the pedagogical and psychological aspects, the other emphasizing the importance of the medical side. Both schools had among them strong and able advocates and both had helped a great deal in the progress of the movement, and it was encouraging to note that there was a tendency now manifest for all workers in this field to act in harmony toward a common goal. It was a distinct achievement that the head of the State Commission for the Feeble-minded was a medical man.

Dr. L. P. Clark said that as he understood it the main purpose of the discussion was to make clearer the application of social psychiatry to the problem of feeble-mindedness. In the first instance, the isolated and aloof position of the State institutions for the feeble-minded as such must be abandoned. In the new order, the State institution could well be made the center of a division of the State in which it could coöperate with agencies such as the poor authorities, schools, prisons, and courts having to do with the various aspects of the feeble-minded. The institutions should be the central bureau for educating these agencies in diagnosing feeble-mindedness and advanced systems of humane care and improving the condition of the feeble-minded. Thus the medical staff of the State asylums and farm colonies would have quite as many and perhaps more important extramural activities to engross their attention than merely training the resident inmates consigned to asylum care. The medical staffs should hold regular children's mental clinics in the various localities of their districts; these clinics should not be dissimilar in character to those planned and projected for the hospitals for the insane. Indeed, a coöperative alliance between the clinics in both fields of work should be encouraged so that the whole field of psychopathies might thereby be covered.

Inasmuch as it was doubtful whether sufficient State provision for the feeble-minded would ever be provided, proper supervision and education of these persons in their own home localities should be undertaken. The

excellent beginning the State had made in providing ungraded classes everywhere throughout the schools showed that the educational authorities were fully aware of their share in the problem. State asylums and colonies should heartily coöperate in this work, and place the experience of their teaching staff at the disposal of these ungraded classes and thus aid in the proper founding of these schools. Further, the speaker believed not only that more adequate medical and teaching equipment of the State institutions for the feeble-minded should be provided, but in order that this force might be thoroughly keen to solve its various problems, a department of research into the nature and treatment of feeble-mindedness should be established in every such asylum or farm colony. Wise and well considered plans of pathological and social research were real and indispensable functions of the modern up to date State government. The enormous number of feeble-minded, epileptic and various types of mental inferiors brought to light in this present war showed that nothing less than the most thoroughgoing and comprehensive plan of research would enable the rooting out of these sapping social defects in American life. New York State should be congratulated upon its well officered venture in taking up this great work.

The speaker wished to add his plea that the neurologists do not allow this whole province of feeble-mindedness to pass from the field of social neurology and psychiatry, into the hands of pedagogues and psychologists, by their attitude of indifference to these issues. Simply because many of the types of examination tests smacked of a scholastic and educational approach, simply because certain aspects of the feeble-minded concerned reactions of a psychological nature, these facts should not be sufficient for neurologists to allow mental defects to be the sole concern of others. They, and not the public, should take the first step. They should show themselves to be able, capable, and willing to handle these defective disorders in spite of their hopeless ultimate prognosis. Who knew but that trained neurological science might in time even remove the stigma that all feeble-mindedness was solely a hereditary and irremediable disorder.

Dr. B. Sachs said that the problem of the feeble-minded had been interesting every neurologist and psychiatrist rather intensively; they had been face to face with it for all the years they had been in practice. He was glad that New York State had been so fortunate as to secure Dr. James for the head of a commission from which considerable progress could be expected. Many people realized that great strides had been made in this city in the last ten years about which time the Board of Education, under the guidance of Miss Farrell, began its special work, and a great deal had been done for children of varying degrees of mental deficiency. The problem was both a social and a medical one. It would certainly be simpler if it could be stated that feeble-mindedness was a matter of heredity only, but it was not merely a matter of heredity. In many of the cases it was acquired, and to

prove this one need only refer to that large group due to disease in the first two or three years of life. In patients who had a distinct heredity the matter was not a simple one. Could anything be suggested to diminish the number of cases of mental defect? That could be done only if there was some way to eliminate from the social system everything that caused it. There was a prospect of diminishing the influence of alcohol, a potent factor in the development of epilepsy, and mental defectives had epileptic ancestors. With the elimination of alcoholic poison from the social body there would be a diminution in cases of mental defect. If there was any commission that could influence any legislature, there was one law that should be passed with reference to mental defect, and that was a law forbidding absolutely the marriage of close relatives. The speaker had watched that matter with regard to mental defectives and delinquents brought to him in private practice and he had been so thoroughly impressed with it that he had never failed to express his opinion when relatives whom he knew had intermarried. It was true that Darwin had ridiculed this belief expressed by observers of his time, but Darwin himself was the offspring of a consanguineous marriage. There had been advances in knowledge since Darwin's time, however, and those who had studied the records could not fail to agree as to the importance of this factor. If the stock was absolutely pure on both sides there might be no danger, but wherever there was the slightest taint there was no doubt that it became intensified by intermarriage.

The question of feeble-mindedness had been driven home to the public in many ways, and any way in which success could be attained was legitimate. There had been one claim brought forward, however, which seemed unjustifiable and that was that the feeble-minded child was more or less a potential criminal. Taking the entire number of defects by and large, the number of criminals among them was remarkably small, if one eliminated the class, not defective but insane.

In many cases mental deficiency could be prevented. The question was, could anything be done for the relief of the already feeble-minded, and the answer was that much could be done through education and vocational methods. Those were so important that another question arose from them and that was whether enough was being done in creating the graded classes in the public schools; whether there should not be for children of this class State institutions which would take the child from the age of three or four years and educate it all the way up. There was a probable objection to that in that the parents, who were willing to send their children to ungraded classes, would not consent to send them to ungraded schools, but that was a sentimental objection that should be overcome, for these children should be taken care of properly from their earliest years. That brought up again the question of teachers for this class of pupils. The education of such teachers was as pressing a need as any. Any number of people had attempted the teach-

ing of defective children, but the average teacher who had not been specially trained for this work was unfit to carry it out.

## THE CHICAGO NEUROLOGICAL SOCIETY

MEETING, MARCH 21, 1918.

Vice-President DR. GEORGE W. HALL, in the Chair.

### CHRONIC SUPERIOR POLIOENCEPHALITIS.

Dr. J. William Davis, by invitation, presented this patient who first came under observation at the Polyclinic in September, 1917. The facial expression called his attention to the condition. When questioned about the eyes, said they had not troubled her particularly and could give no definite time of onset. When questioned concerning diplopia said that at times she had seen things double, but such occurrences were infrequent and of short duration and never troublesome.

The patient was thirty years of age; the seventh child in a family of eight. All her brothers and sisters were living and well, except the youngest who died of meningitis when eighteen months old. Mother was living and in a fair state of health at sixty-nine years of age. Father died of bronchitis in his forties.

The patient gave birth to a child ten years ago. It died when eight months old, cause not known. No history of miscarriage. Seven or eight years ago she had severe headaches, which were almost constant for several months, during which time she took a great many aspirin tablets. Following this she was treated for rheumatic fever. Six years ago had pleuro-pneumonia. There was a tendency to return of the rheumatic condition for several years following and the patient had her tonsils removed a year ago. The symptoms upon first examination were as at time of presentation, with the possible exception that the ptosis, especially of the right side, was not so marked. This was probably due to the decrease in the fatigue which was increased by reading.

Upon examination he found a bilateral ptosis of moderate degree. All the branches of the motor oculi supplying the extrinsic muscles were involved, especially the branch to the superior rectus which was most paretic of the group. The patheticus was involved; she would shift the head when attempting to focus vision on an object held in the manner one would hold a book when reading.

The abducens was also involved, the patient being unable to rotate the eye globe outward to any great extent. Of the intrinsic muscles the branch of the third which supplied the contracting fibers of the pupils were also paretic, the pupils being dilated. The pupils also showed a marked degree of sluggishness approaching rigidity. There was also a slight irregularity. The characteristic facial condition—the



patient holding the head slightly backward, bringing into action the frontalis muscles in an attempt to look from under the drooping lids—was best brought out when she attempted to look at an object held slightly above her normal line of vision. Laboratory report on Wassermann was ++.

*Discussion.*—Dr. Moyer thought the condition was not very rare. One saw all kinds of involvement of the eye muscles, sometimes complete, sometimes internal or external. They frequently occurred as the result of syphilitic infection. He had seen a few similar cases.

Dr. James C. Gill thought the disturbance was not confined to the eye muscles alone. The young lady had had difficulty in deglutition at times and the tongue did not protrude in a normal way. There seemed to be some disturbance of the motor cranial nerves below the sixth.

Dr. G. B. Hassin stated that superior poliomyelitis as first described by Wernicke indicated a central lesion of the oculomotor nerves which results in an ophthalmoplegia with the principal involvement of the extrinsic eye muscles. In some cases of central third nerve lesion the intrinsic muscles of the eye are involved and the extrinsic spared. In this case the simultaneous involvement of both the extrinsic and intrinsic eye muscles would rather speak for a peripheral lesion of the third nerve which is commonly caused by a basilar meningitis. The slight involvement of the seventh and sixth nerves would also indicate a peripheral rather than a nuclear process, as the latter could not very well explain the simultaneous involvement of the third, sixth and seventh nerves.

Dr. Michael Goldenburg thought from the examination he had made that there was not a complete external ophthalmoplegia present. The patient had some adduction and some abduction, and there was limited elevation. Where a complete external ophthalmoplegia had been present in the few cases he had seen there was also a marked exophthalmos and, as a rule, a divergence. He recalled one case in particular where in a complete bilateral ophthalmoplegia, external and internal, the eyes were stationary and there was no reaction to light, with marked exophthalmos, the eyes were turned upward and outward. It was purely luetic. In the present case there was some motion. He had not heard the paper but believed there were quite a number of similar cases and the treatment which seemed to be of most value in his hands was large doses of potassium iodid. Until they reached 125 or 130 grains three times a day they did not get results; they frequently started with a dram and got results in that way.

Dr. Emory Hill said his impression upon hearing the paper was that the case was one of syphilitic meningitis. It was his understanding that a meningitis was the usual cause of this type of ocular palsy. He thought there was a degree of exophthalmos, not extreme, but he did not see why there should be much exophthalmos in such a case as this. It would be of interest to see how the case turned out. In his observa-

tion these ocular muscle pareses usually cleared up to a considerable extent.

Dr. Joseph Beck stated that he had a case of complete ophthalmoplegia in a man of seventy, who had an infection in the nose, in the sinus, confined to the sphenoid. The patient went to a fatal termination and he was able to look in and found that there was a complete necrosis of the sphenoid bone. The ophthalmoplegia was complete of the extrinsic as well as the intrinsic muscles. There was also protrusion of the eye which was alternating in each eye. It was measured by the exophthalmometer. It was the effect of the ciliary nerve on the retrobulbar blood vessels. The case was a simple chronic infection.

Dr. J. William Davis, in closing, stated that there was an involvement of the third nerve in all its branches, the fourth and sixth in the inflammation. The apparent lack of symmetry of the face was due to an abscessed tooth. The patient had been receiving intramuscular injections of mercury and potassium iodid per mouth and was at present under the same treatment. At no time had she had a complete paralysis. The superior rectus had seemed to him to be the most involved.

#### CASE OF ACUTE POLIOMYELITIS, PRESENTING RATHER UNUSUAL CRANIAL NERVE COMPLICATIONS.

This paper was presented by Dr. George W. Hall and is printed in full in this issue. (See p. 445.)

*Discussion.*—Dr. Greenfield Sluder, St. Louis, said it had often been claimed that doctors suffered in securing service for their families, but if anyone had trouble of this sort he recommended them to seek Chicago for their services. Such painstaking and efficient services were rendered to him that he thought they would not easily be equalled in the history of the profession.

The patient, his child, began on the first of September to have what appeared to be a common coryza; of the household, consisting of eleven people, ten had the coryza. It started with him about the middle of August, and they all had it, this girl contracting it last of all. It was so trifling that many of them had difficulty in recalling whether they had it, for the disturbance lasted only a day or two. Some were more affected, his wife had a bad time, but the other children had a very slight infection. The patient was not confined to bed at first, but lay about on the porch during the first day. The following morning she had a temperature of 101° F. and complained of headache. She had a very clearly marked frontal sinus case, the middle meatus of the nose was blocked shut and there was a profuse serous secretion, but no roughening of the surface. He considered it merely a little frontal blocking and thought it would amount to nothing. The next day there was the same story, with a temperature of 101° F. The third day the child

complained that she saw double, which was confusing because she had had a diplopia before; she was slightly hyperopic. Dr. Tuttle came in to see her and recognized the stiff neck and exaggerated reflexes and the child was brought to Chicago. She had had a perfectly clear, definite frontal sinus case. Dr. Brennemann saw her and said there was no question about the meningitis. The next thing was the development of the right eye trouble; the whole nasal picture vanished after lasting for three or four days. Dr. Sluder then got a satisfactory examination of the fosi ethmoidal-sphenoidal region and found the epithelium of the district thickened and roughened and pale. He thought there was no question but that the infection of some of the other members of the family was the same thing. The question of poliomyelitis was settled but the mode of invasion was not considered cleared up, the infection sometimes passing through the nose and sometimes through the intestinal tract. He had recently seen that the flea of the common rat was supposed to be a carrier of poliomyelitis. It had seemed to him that the coryza was the origin of the poliomyelitis and that they had all had it. There had been no other case in that part of the country before or since. He thought that when the time came that the organism of poliomyelitis could be recognized as easily as some of the other organisms the source of invasion would be cleared up.

He started the treatment with carbolized oil through the olfactory fissure. He did not try to inject the sphenoid sinus directly because the trauma in such a procedure was more than the average case would stand and might intensify the infection. The forcible injection of the olfactory fissure he had proved on the cadaver caused it to balloon out and part of the injection would enter the sphenoid sinus. If the opening was very small this might not fill it, but in an average case he felt sure some of the fluid would get into the sinus. In his little girl this did well, the vision improved fifty per cent. in twelve hours and the nerve condition subsided. There was a recrudescence after they returned to St. Louis and she had complained of scotoma—she could not see the window in full sunshine. There had been a total recovery of the optic nerve disturbance. The nerve was normal in appearance and the visual acuity was normal; she still said, however, that the high light reflex on shining objects was not quite as bright for the bright eye as for the left. He felt that there was some other underlying factor that permitted the infection of poliomyelitis to develop—some unknown factor, and he thought that came definitely into consideration.

Dr. Hugh T. Patrick thought it was always embarrassing and generally venturesome to express an opinion about a case one had not himself examined. It was reckless to differ in opinion with skilled men who had seen the case but, as he had explained to Dr. Hill, the unwritten motto of the Society was "When you see a head, soak it." Consequently, he ventured to inquire why the diagnosis of poliomyelitis was ever made—he saw no reason for such a diagnosis. Taking the his-

tory of the case, and of the family, and the isolation of the household through which the infection ran he saw no reason for considering it a poliomyelitis. There were none of the usual symptoms of that disease. The symptoms were all unusual symptoms which rarely occur and the real symptoms by which the disease is known were absent in this case. Why was this not considered a not very unusual case of serous meningitis. Such cases as had been described by Strauss of New York in various infections about the ear and head. As Dr. Hall read his report it seemed to him that one could not reasonably come to any other conclusion because all the symptoms were those not of poliomyelitis but of a meningitis of some kind. Considering all the findings and the outcome of the case it seemed to him that a serous meningitis caused by some unknown infectious agent was the reasonable diagnosis in this case.

Dr. James C. Gill, in answer to Dr. Patrick, said that there was no absolute way of determining that it was or was not poliomyelitis. Still, he thought there were cases on record in which a diagnosis of poliomyelitis had been made in which the symptoms simulated those presented in this case very closely. The fact that many members of the household were affected with a similar disturbance about the nasal cavity was no reason for supposing that they all had poliomyelitis; one member might have it and the others not. In this particular case he thought it might be the meningitic form of poliomyelitis. Undoubtedly there was evidence of the involvement of the meninges. Whether there was any involvement of the nuclei of the cranial nerves, the sixth, seventh or eighth, and possibly even of the twelfth, they could not say. The fact remained that if there had been a nuclear involvement such as is found in the spinal cord involving the ganglion cells, it entirely cleared up and left nothing behind it. The possibility of its being a meningitic form with considerable exudate and infiltration on the right side that involved those nerves by pressure he was sure might be thought of. The disturbance on the right side with the exaggerated reflexes and the positive Babinski he thought would indicate that there was considerable pressure, possibly from involved meninges. The spinal fluid showed nothing so far as any organisms were concerned. The usual types of meningitis usually showed some organisms, but in this case there was nothing to be found in the fluid. These cases were quite common. He had a similar case two years ago in a young man who attended a football game on a cold day and was perfectly well. The night of the game he attended a reunion of his class in a hot room, was up late and the next day developed a coryza. On his return to Chicago three days later he had a high temperature and the following day had chills with paralysis of the left sixth and seventh cranial nerves and following that almost complete paralysis of the right arm and leg which cleared up in a few days and left a paresis. This condition remained for three or four weeks. This might have been a case of serous meningitis, but believed it to be cerebral type of poliomyelitis.

Dr. Hugh T. Patrick thought the spinal fluid indicated a meningitis. The purely meningitic forms of poliomyelitis were rare except during an epidemic when the paralytic forms were numerous. Such pareses as this child had were not of the type of poliomyelitic paralysis at all. Spastic paralysis with increased knee-jerk and Babinski was not the paralysis that one found in poliomyelitis. If any one should ask him to prove that this was not a poliomyelitis, of course he could not do so, But if Dr. Hall had reported it as a serous meningitis he would have accepted it. You don't have eleven people with poliomyelitis in one family and no paralysis whatever and one case of meningitis. There was no sign of nuclear involvement of the cranial nerves, no signs of involvement of the anterior cells of the spinal cord, none of the disability which went with the destruction of the motor cells, and he saw no reason why the assumption should ever have existed that it was a poliomyelitis. He was entirely willing to admit that it might have been poliomyelitis, but not to admit that it was a probability. Probably there was meningitic involvement in all cases of poliomyelitis. A long time ago he had seen a case in which there was involvement of the sixth and seventh, the extremities untouched; the child died and when the sections were being made he was told that there was cellular infiltration of the membranes where the sixth and seventh nerves come out. He said they would have to find something more than that, and when the nucleus was reached there was the evidence of the disease which caused the facial palsy.

There was nothing whatever in this case to indicate that there was a poliomyelitis; what there was was the general infection running through the family—he doubted if anyone had ever seen eleven people in one family afflicted with poliomyelitis. Except during epidemics, he doubted if anyone had ever seen more than two or three cases in a family. Taking the case as a symptom-complex he failed to see why the assumption was ever made that it was poliomyelitis at all.

Dr. Gill agreed with Dr. Patrick. Still, there were a great many cases, so-called abortive cases, in which the gray matter of the spinal cord was involved, they left no trace afterward; and it was quite possible that in this particular case there might have been some involvement of the nuclei of the cranial nerve without leaving any disturbance afterward. It did not stand that because all the members of the family had a coryza that they should all exhibit signs of involvement of the nervous system.

Dr. G. B. Hassin believed that poliomyelitis with a cerebral localization might have caused some of the symptoms in this patient, as Babinski, exaggerated reflexes, etc. In former years when the various types of poliomyelitis were not so well known, cases of poliomyelitis with cerebral localization frequently used to be diagnosed as influential encephalitis of Strümpell. Though objections to the diagnosis of poliomyelitis in a case with the symptoms of cerebral lesion cannot hold good, yet in this

case a diagnosis of serous meningitis would be more proper as it would much better explain the symptoms presented.

Dr. Joseph Beck stated that two years ago when Dr. Nuzum of the Cook County Hospital and Dr. Sidell of Wichita were working on the poliomyelitis cases at the above institution, they investigated them for the organism. Dr. Nuzum believed he had discovered the specific microorganism and in a few cases he made washings of the antrum, carefully obtaining the fluid from the antrum alone. Dr. Nuzum was sure that the cultures obtained there were similar to those obtained from the tonsil by Dr. Sidell. In the nasal examination of these polio cases he had seen one in which the symptom-complex, which was mentioned in this case, was quite similar, and that almost cleared up entirely. He called it a localized meningitis with serous meningitis. A localized plastic affair more evident along the base than anywhere else, but that case had some of the definite symptoms that Dr. Patrick mentioned; the leg symptoms remained and the cranial symptoms remained. There were ocular symptoms such as Dr. Hall mentioned in this case; there were symptoms of the papilla. They laid great stress on enormous doses of urotropin and believed that they had proved it a remedy for this condition. He had not seen many cases like this in practice.

Dr. Emory Hill said that the unilateral character of the choked disc was the interesting feature from the standpoint of the eye. He would judge from the history and Dr. Brown's notes that there was a sixth nerve paresis as well as a seventh and eighth. He had not seen the case, but Dr. E. V. L. Brown had seen it but was ill and could not be here so had sent his notes to him. One would more naturally expect a bilateral papilloedema in a case of this sort, yet it was true that one disc might be swollen in general intracranial conditions, or one would be swollen more than the other one, and while it is not the rule it is sometimes true that the greater swelling is in the eye opposite the side on which the intracranial lesion exists. This is not an impossible symptom in this case. One could imagine a meningitic process resulting in an optic neuritis with a good deal of edema giving this type of rather high protrusion of the disc. The rather rapid subsiding of the swelling of the disc was not a particularly infrequent thing in the course of various processes which produced a choked disc. He was not sure whether he drew the correct inference from Dr. Sluder's remarks, but he interpreted him as drawing some connection between the treatment of the sphenoid and the subsidence of the choked disc. He thought one would have to be very cautious about attributing improvement in papilloedema to treatment of the accessory sinus. For some years there had been such reports. He had never seen a case of papilloedema which he believed to be due to the accessory sinuses, and knew a number of eye men who had had a similar lack of experience in seeing such cases. There were certain anatomical difficulties there. One could understand a sinus infection with infiltration into the orbit which would produce a

good deal of pressure upon the orbital contents. With such a thing one might get an optic neuritis and at the same time have an edema of the conjunctiva and protrusion of the eyeball, but a condition of optic neuritis alone—without any of the other things—was a little hard for him to understand. He did not see how pressure from a sinus could produce such a condition. A condition of pressure back of the entrance of the central retinal vessels into the optic nerve could hardly explain such a swelling. There was no active lymph circulation traveling back, the circulation of the eye was too sluggish. That was indicated rather clearly in certain cases of hypophysis disease where the pressure of the enlarged hypophysis upon the optic nerves at the chiasm resulted in shutting off the lymph spaces and choked disc does not occur, but on the contrary a primary optic atrophy. It was not a matter of damming back the lymph flow on the side toward the eye, but a matter of engorgement and came from obstruction to the venous flow. He thought the sphenoidal condition could not be called into consideration as the cause of the choked disc in this case, or the treatment of that condition credited with the relief of the choked disc. It must be remembered that the case under discussion was one of papilloedema and not a descending neuritis such as pressure at the optic foramen, due to a sphenoiditis or posterior ethmoiditis, could produce.

Dr. Michael Goldenburg stated that he knew nothing whatever about poliomyelitis, had never examined a fundus in the course of that disease, but the eye findings were interesting. Apparently it was a choked disc and not a neuroretinitis. The rapidity of the subsidence was in favor of that. The possibility of the sinus producing a neuroretinitis was very good. He had seen a case in the last ten months in the wife of a physician who came in with a typical neuroretinitis. The history was gone over very carefully but was negative. Serological tests were made and all proved negative. The only other possible thing he could think of was a sinus involvement; the X-ray showed a little shadow in the posterior ethmoidal region. He put the matter up to the patient's husband, told him he was not sure the condition was due to the sinus, but suggested opening the ethmoid cells, which they did and immediately the neuroretinitis subsided. He told several rhinologists of the case and they doubted it. The vision was down to about 10/200 and came back to 20/30 with correction. A month or so afterward the patient came in with a typical purulent involvement of the maxillary sinus on that side. The antrum was cleared up and then the optic neuritis cleared. He thought it had nothing to do with the return circulation or the circulation, but thought the infection traveled up by continuity of the tissues. The ethmoid cells were almost as thin as tissue paper and not infrequently the sphenoid wall was so thin that a probe could be pushed through it without any difficulty. The lady has had no return of the trouble, but at present the lower inner portion of the disc is pale and there was some exudate on that part of the disc.

He asked Dr. Sluder if perimetric charts were made and if the blind spot was measured. (Dr. Sluder replied that everything was normal.)

The teaching in Vienna at Fuch's clinic was, given a case of unilateral optic neuritis, ability to exclude syphilis, the ethmoidal cells, regardless of what the neurologist or rhinologist said, should be opened.

Dr. Joseph Beck agreed with Dr. Hill that the number of cases of sinus disease without neuroretinitis was surprisingly small. Dr. E. V. L. Brown and he had a case, however, in which there was nothing about the nose that indicated involvement, but the lady could only see the finger at close range. This loss of vision occurred in three weeks following a severe retinitis. The diagnosis of neuroretinitis, fuzzy retina, secondary to sinus infection was made by Dr. Brown, who asked him to do a little sinus exploration. This was done with the result that within three or four weeks the vision returned to 20/30. Such cases did occur. In the sinus there was usually a non-suppurative ethmoiditis, but the examination indicated no disease. He thought the treatment in Dr. Sluder's child was very efficacious.

Dr. Sluder considered Dr. Hill's statement so comprehensive and so at variance with his experience that it was a privilege to have an opportunity to speak again. From the anatomical standpoint, the optic canal was lined with either the post-ethmoidal or sphenoidal, one or the other. It might be totally the post-ethmoidal or the sphenoidal and that might involve the optic canal about three fourths of its distance almost completely. As to how many times an optic neuritis followed a cell infiltration, he had seen many times with a pharyngoscope—at the time the cell wall was cut out the cavity was perfectly clear so this machine could be inserted and one could look around,—he had seen the lesion on the optic canal that put the eye out in three instances. This was Gundlock's method and the lesion could be plainly seen.

Dr. Hall, in closing, felt that Dr. Patrick had based his objections to the diagnosis largely on the sporadicness of the case. He had seen a good many cases in the last epidemics in the County Hospital, and there was nothing which did not fit in typically with a bulbo-spinal type of poliomyelitis. Dr. Patrick was willing to admit the possibility of the nose being a source of infection, the time of year suitable for the infection, the number of cells in spinal fluid so typical that one could not get away from it, and that these forms of poliomyelitis are practically always unilateral. That he could be shown through the statistics of the Rockefeller Institute that such cases had run a course of eleven weeks and that such a leukocytosis is usually present in cases of poliomyelitis. Dr. Hall was not willing to admit that cases of serous meningitis were frequently found showing these findings. The cases as reported by the Rockefeller Institute were so typical that this was almost a clear picture of anterior poliomyelitis, including the nystagmus and Babinski on the same side, the localized nerve lesions, including especially the cell count which was present, and absolutely typical was the



course and the Nonne reaction. Dr. Patrick was willing to admit that cases did occur sporadically; also that in the epidemics we not infrequently found cases of more or less severe poliomyelitis, and still more frequently the abortive type of cases.

### THREE UNUSUAL SPHENOPALATINE GANGLION CASES

Dr. Greenfield Sluder presented this case. (See this issue of the JOURNAL, p. 447.)

*Discussion.*—Dr. Joseph Beck stated that he had had the pleasure of hearing a number of papers along this line from Dr. Sluder and following his first presentation of this matter he had tried to follow him in the injection of the sphenopalatine ganglion. He had found conditions different from what they should have been in quite a number of cases, just as Dr. Sluder described it. He had never seen a complete picture with all the areas involved, but the area back of the eye with the pain radiating down to the shoulder and into the arm, he had seen quite a number of times. He had probably injected the sphenopalatine ganglion two hundred times and perhaps some of the cases were not as well selected as they should have been, but the results had been satisfactory in that the pain was controlled in the majority of the cases. How permanently is another question. In each case the diagnosis was first made by the local anesthesia of the sphenopalatine region. In cases where a result was obtained from cocainization (the pure flake used in this area localized it to that region) he injected the ganglion if he could. (This was an important part in that the technic of injection was not always easy.) In some cases the partition behind the middle turbinate body into the ganglion was very hard and he had had cases where he had to hammer through with a mallet to get through into the ganglion region and in some cases had to give it up. As to the results; there were untoward results in this treatment. Holmes of Boston, and H. L. Pollock of Chicago reported several hemorrhages. In one case where he (Dr. Beck) was called down to Marion, Indiana, the patient nearly died from the hemorrhage following the injection and subsequent manipulation of that region. The injection in this case had been made in Chicago and five weeks later the patient had a severe hemorrhage which was controlled by post-nasal or anterior packing by the physician there. The patient recovered from the effects of the hemorrhage and also from the pain. She had now been free from pain for about five months. In one case there had been paralysis of the abducens following the injection, which lasted for about three months. Dr. Patrick had referred a case to him two or three years ago in which following the injection the patient became bed-ridden and could not walk. He could never explain how that occurred, and there was no result so far as the pain was concerned. It was not a typical sphenopalatine ganglion condition and the injection was not satisfactory. He wished that Dr. Sluder had brought

along some of the specimens he had injected and shown them with the colored fluid, demonstrating the difficulties. He believed the treatment had a very decided value where no definite lesion of the sinus was shown and yet the symptom-complex was present.

Dr. Hugh T. Patrick said that his attention had been called to this symptom-complex some years ago by Dr. Bliss, who had worked with Dr. Sluder, particularly as regarding the anatomy. Dr. Bliss was very much interested in it some five or six years ago and Dr. Patrick had then begun to be on the lookout and had been keeping one eye open for them ever since; but probably should have had two eyes open as he had not seen very many. Yet he believed he had seen a good many cases, perhaps an unusual number of pain about the head and face and neck. Perhaps because of having injected the trifacial so often these cases were sent to him but this particular syndrome not due to other obvious thing he had seen infrequently. He remembered the case he sent to Dr. Beck, which was not typical but which seemed to be more than anything else. In another case, which was sent to another rhinologist, there had been profuse hemorrhage and the last he heard the patient was no better than at first. In another case nothing was done because the patient declined to have the operation performed as Dr. Patrick declined to promise relief from the injection.

He thought a thing that seemed to be rather similar in its general manifestations to this syndrome was the so-called indurative headache which occurred nearly always from infection about the head, the pain being occipital, radiating into the neck and down to the shoulder, he believed largely because of involvement of the cervical joints. This was partly arthritic and probably partly due to involvement of the structures in the suboccipital region. He pleaded guilty to not being sufficiently alert to this particular syndrome, and particularly in sending such cases to the rhinologist to have the cocaine test tried. He thought he should do this oftener, but the great majority of similar cases seemed to be capable of other interpretation. On the whole, the patient had generally recovered from this sort of thing by removal of infection and without injection of the sphenopalatine ganglion.

The cases reported by Dr. Sluder were of exceedingly great interest and seemed to be quite conclusively demonstrable. The fifth case, of ophthalmic migraine, was entirely outside of the ordinary interpretation of these cases; it was very interesting and he would not contest any possibility about migraine. He did not know what caused it and if Dr. Sluder could put it in the spheno-ethmoid region he would confer a great favor on a great many physicians all over the world. So far as he knew, no one had ever determined just what produced a migraine and he saw nothing unreasonable in this report—that the attacks were precipitated by coryza, just as they were by railway travel, by shopping excursions, by having the bowels upset and all sorts of things, but he

did not believe that the fundamental cause lay in that region, and doubted if Dr. Sluder thought that himself.

Dr. Greenfield Sluder, in closing, said that Dr. Beck had spoken of a number of things he felt he could not touch upon in the time allowed him. There was often profuse hemorrhage. He had injected this area probably 1,000 times and three times with his needle had opened these vessels; usually the needle would slide by, but three times he had opened them and the hemorrhage was very annoying. Four times in his experience he had seen subsequent sloughing five days after the injection and it was very trying but, unfortunately, the number of these cases was very small. He was interested to hear Dr. Beck report a sixth paralysis; he had once produced one instantaneously. In that case as he held the needle with the syringe and starting the piston to go in he was startled with the ease with which it slipped. Usually some pressure was required and the injection went very slowly, but this went quickly and the patient said instantly "Oh, I cannot see!" The eye was turned in and it took three months for a total recovery, but it did recover completely.

Dr. Beck had also alluded to properly selected cases; this was not always easy. If cocainization of the ganglion gave only very slight or very transitory relief that case was usually not satisfactory for injection. It was his own practice before injecting these cases to put them to the test time and time again and have it complete and satisfactory.

Dr. Patrick had spoken of indurative headache; he had watched these patients for a long time, but he had never found one that had an indurative headache that had knots on it. He never had found the welts that were in his mind first associated with indurative headache, and if Dr. Patrick would elaborate that it certainly would help him. The question of migraine was, of course, a very complex and ancient one. It was recorded in the second century after Christ and all the doctors had been after it from then until now. Moebius gave one of the few explanations of migraine that he had found—a clearly outlined definition of migraine was not easily found. Moebius gave it as an inherited stigma; he wound up with the idea that if certain individuals were capable of suffering with a migraine they did so, but if incapable they could not suffer. The ophthalmoplegic migrain with paresis had seemed to him to be definite lesion involving the third, sixth and fourth that developed at the time of the sphenoidal disturbance, registered at the time of the headache. The epileptic migraine was simply that a fit developed at the height of the pain; that was a typical sphenoidal migraine and the result was obtained with treatment of the sphenoid. Liveing put it that they were lesions of the sensory ganglia with peripheral exciting causes. One of the most frequent exciting causes was that epitomized in this case—the nasal cavity.

## Current Literature

### I. VEGETATIVE NEUROLOGY

#### 1. VEGETATIVE NERVOUS SYSTEM.

**Binet, L.** THE CEREBRAL PULSE AND THE EMOTIONS. [Compt. rend., 1918, 166, pp. 505-508.]

In men subjected to the noise of a revolver or siren the cerebral circulation is modified, but the changes are variable, in some cases in the direction of anemia, in others in that of congestion. the changes are parallel to those in the digital pulse. The great error in this type of experimentalism which too frequently vitiates all this kind of work is the assumption that the sound of a revolver shot means the same thing to every one. Anyone but superficially acquainted with the psychology of the unconscious knows that a revolver shot means different things to every one, hence the variability in results in this kind of experiment and the usually silly and superficial judgments drawn from them especially by many animal behaviorists.

**Nyström, G.** BONY SENSIBILITY AND PAIN. [Upsala Läk. Förh., Vol. 22, 1917. No. 4.]

After a review of what has been written on bony sensibility the author describes the results of experiences in thirteen operations on bones, including a case of sarcoma of the tibia in a girl of nine. Experimenting upon himself, as well, having a surgeon expose the tibia and bore into it at two points, above the middle, and again near the malleolus. His findings were that the periosteum is richly supplied with pain nerves, but the bone tissue itself seems to be insensitive. The marrow has scanty pain conduction; the sensation from them resembles an ache, and is brought out only when larger areas are involved.

**Lewis, T.** REPORT IN NEURO-CIRCULATORY ASTHENIA AND ITS MANAGEMENT. [Military Surgeon, 1918, XLII, 409. Cleveland M. J.]

Lewis renames in this report Da Costa's "irritable heart of soldiers" and his own "effort syndrome"—neuro-circulatory asthenia. The early recognition of these cases is emphasized. These men who are suffering from the symptoms and who have the physical signs of the disease should be carefully weeded out before being sent over-seas. Exercise tests form the most valuable criterion of physical fitness—cardiac or otherwise.

One-half of the cases have had symptoms previous to enlistment. The men give a history of having had dyspnea on exertion with occasional attacks of syncope; they prespire freely, flush readily and have never been able to perform heavy labor. Some have asthma or have chronic nasal obstruction. About 23 per cent. gave a history of acute rheumatic fever (more common in England than in the United States).

The exciting causes were. (1) Infections: Acute rheumatic fever, trench fever, dysentery, diarrhea. (2) Prolonged physical and psychical strain (long service in the trenches, shell-shock, gassing and burial). Venereal disease, alcohol, tobacco and coffee play no appreciable part in the history of N. C. A. Because of the prominent rôle which the infections have in causing the disease, a proper convalescence should be allowed.

The chief symptoms were: Dyspnea on exertion, pain in the left chest; precordial, palpitation, headache, dizziness, faintness, ready fatigue, susceptibility to cold, tremor, free perspiration and hyperalgesia of the precordium are complained of. Sir Clifford Albutt has called attention to the fact that the pain of true angina pectoris is characteristically substernal whereas the pain in N. C. A. is rather more mammary or pectoral in location. There is a striking disproportion between the severity of the subjective symptoms and the rather minor abnormalities which constitute the objective signs. The facial expression is one of exhaustion or anxiety. Two types are seen: (1) The pasty or pallid. (2) The erethic type with high color and dermatographia. On stripping the patients shiver and large beads of sweat are seen on the axilla. There is a coarse tremor. Apex beat is diffuse in some, forcible in others. There is marked pulsation in the peripheral vessels with a pistol shot in the femorals. The heart is accelerated while the patient is awake—90 to 100. There is a marked difference in the count between the dorsal, standing and after exercise rates. The respiratory irregularity is marked and occasionally extra-systoles are felt. To climb a flight of stairs rapidly has been the exercise test used. The pulse rate should return to the pre-exercise rate in two minutes. If the length of the return is in excess the man will not be able to stand the route marches or the thirty-minute drills. In cases of N. C. A. the pulse may be imperceptible. A suggestion of a systolic thrill may be present at the apex. Pure systolic murmurs per se are disregarded irrespective of location, intensity or transmission, if there is no history of repeated or recent attacks of rheumatic fever. Several attacks or a recent attack of rheumatic fever, slight cardiac enlargement with severe or persistent symptoms and low tolerance for exercise—irrespective of the murmur, are grounds for discharge. A systolic aortic murmur without a thrill or anacrotic pulse and characteristic pulse pressure is disregarded. The after histories of the soldiers with systolic murmurs (11.2 mos.) show

that they do just as well as other men. The blood pressure in repose is normal but the reaction to exercise is exaggerated. Electrocardiograms show the normal complex. A system of graduated exercises is used for sorting and therapy. Doubtful cases of organic disease are correctly diagnosed through the use of these exercises. Five routine army drills, suitably arranged and graduated, are used. The first exercises are given for 15 minutes and the last three for 30 minutes. The longer drills are supplemented by route marches of two to four miles. The men are examined after the first drill and after every change. The toleration for exercise is the best guide for the disposition of the cases, but the history and physical examination are of some aid. The men referred to the heart hospital are classified: (1) full duty; (2) light or later full duty; (3) sedentary military employment and permanently unfit. Rest and symptomatic treatment is not advised. Of 558 cases seen in 1916, 272 (49 per cent.) were referred to full duty. The remainder were discharged. Two hundred sixty-two of the former were traced 11.2 months later and showed that 108 returned to full duty; 109 were returned to light duty and 45 were discharged as permanently unfit. Since about half of the cases had symptoms prior to enlistment, measures of prophylaxis should be applied and a longer period of convalescence should be allowed after infections. Men who are observed as having symptoms of N. C. A. should be reported to the medical officers. Men suffering from this symptom complex should not be permitted to go over-seas.

**Ghedini, G.** EPINEPHRIN TEST OF FUNCTIONAL CAPACITY OF THE HEART. [*Gazz. d. Osp.*, Vol. 39, 1918, May 16.]

Injections of epinephrin often contract peripheral vessels: The response varies with the amount of epinephrin already circulating in the blood, also depends upon degree of vascular wall resiliency that may be present, and with other conditions. The pharmacodynamic reaction thus varies widely in different persons and in the same person at various times, giving contradictory findings. Thus some patients presenting a strong reaction and others none at all, even under apparently similar conditions. By combining the test with careful investigation of the blood pressure and pulse before and after, a dependable oversight of conditions may be obtained. Ghedini uses the Uskoff sphygmotonomograph, the Pachon oscillometer with recording drum attachment, or other apparatus of the kind, used in connection with the epinephrin test. The epinephrin test is simple and easy, and seems to be harmless in his experience.<sup>1</sup>

<sup>1</sup> [This is, however, not the case in certain individuals, where there is an intense vagotonia or sympathicotropia where the epinephrin stimulus to an already over-active sympathetic may induce collapse. Ed.]

**Signorelli, E., and Buscaino, V. M.** BRADYCARDIA AND OCULO-CARDIAC REFLEX IN AMEBIC DYSENTERY. [Riv. Patol. Nervosa e Mentale, 1917, Nov. 17, Vol. 22, No. 11, pp. 487.]

One of the clinical symptoms which the authors observed in patients suffering from amebic dysentery was bradycardia, which they found constantly in the second period of the illness after the dysenteric crisis was past. This symptom was observed in the cases which recovered spontaneously as well as in those treated. Systematic examination of the cardio-vascular mechanism during life, and in six cases the post-mortem examination, gave no evidence of organic lesion, to account for this condition. The authors therefore made experiments by injecting subcutaneously atropine and adrenalin and noted that the pulse rate rose finally to normal or above. They conclude that the condition of bradycardia is a functional one and that it is due to vagotony and not to inactivity of the sympathetic, which is on the contrary excitable. Testing the oculo-cardiac reflex after the method of Petzetakis they found it normal in about 17 per cent. of 150 cases while in about 81 per cent. it was weak, abolished or inverted. By further experiments during the primary phase of the action of atropine they established the absence of any interruption in the trigemino-vagal arc during the period of bradycardia and the presence of some degree of sympathetic hypertony. They explain the genesis of the condition of bradycardia on the assumption that the plexus of Meissner is stimulated excessively during the process of healing of the submucous abscesses caused by the amebæ.

**McCollum, Simmonds, and Pasons.** A BIOLOGICAL ANALYSIS OF PELLAGRA-PRODUCING DIETS. V. THE NATURE OF THE DIETARY DEFICIENCIES OF A DIET DERIVED FROM PEAS, WHEAT FLOUR, AND COTTONSEED OIL. [J. Biol. Chem., 33, 1918, p. 411.]

Chittenden and Underhill recently reported having produced in dogs a condition exhibiting symptoms similar to pellagra by feeding them upon a diet of cooked (dried) peas, cracker meal, and cottonseed oil (see Abstract No. 1778, Vol. III., p. 432). These authors suggested that the abnormal condition might be referred to a deficiency of some essential dietary constituent or constituents. McCollum and his co-workers have examined the dietary deficiencies of the ration employed by Chittenden and Underhill. Supplemanting this diet with caseinogen and the "fat-soluble A" (butter fat) failed to render it adequate for the growth and satisfactory nutrition of rats. The primary deficiency limiting the nutritive value of the basal diet is that of the inorganic elements Na, Ca and Cl. No matter how well the proteins of this diet are supplemented with purified protein addition, with or without increasing the content of the diet in "fat-soluble A," growth cannot take place until these three inorganic elements are added. These latter are not, however, alone sufficient. Either the protein or the "fat-soluble A" must be increased in amount as well, for growth to take place.

Normal nutrition and development were shown by rats fed upon the basal diet supplemented by caseinogen, butter fat, and the three inorganic elements. It is considered that these results form a strong argument against the idea that pellagra is a disease in the same category with beriberi, and the xerophthalmia caused by a deficiency of the "fat-soluble A." The rats fed upon the basal diet of peas, cracker meal, and cottonseed oil, did not exhibit the pathological conditions of mucous surfaces of the alimentary tract, nor the skin changes and infections observed by Chittenden and Underhill in dogs. They showed loss of weight and the early appearance of senile characters. [Physiological Abstracts.]

## 2. ENDOCRINOPATHIES.

**Mohr, L.** STATUS LYMPHATICUS. [Berl. kl. Woch., June 3, 1918.]

Three case histories are here presented in which a hypertrophied thymus produced compression of the trachea, the resulting disturbances being more or less marked. The symptoms may be due to polyglandular disturbance and assume the most varied mosaics. The present observation places hypertrophy of the salivary and lacrymal glands and tonsil in the foreground. The diagnosis of persistent enlarged thymus is made by palpation and percussion. Mohr believes that the gland can be percussed when it attains the weight of about twenty-five grams. Radiography may give a shadow over the aorta, the best angle being from behind forward and from left to right, when the shadow is thrown well into relief.

**Palancar and Arcaute.** THYMIC DEATH. [Arch. Esp. de Pediatria, April, 1918, 2, No. 6.]

The authors maintain that a diagnosis of thymic death should be made upon the microscopic findings rather than upon the gross appearance of the thymus gland. In one of two cases reported the thymus of a four months' old child weighed 28 gm. The child seemed healthy and the parents were young and healthy. It had had one convulsion at two months of age. The microscope showed marked increase of functional activity and proliferation. Another child had died suddenly at the eleventh month, but the thymus had not been studied. The thymus in certain cases may exert a purely toxic influence independent of any mechanical action. With hyperplasia there may be perverted functioning, which may cause grave disturbances.

**Hart, E. B., and Steenbock, H.** THYROID AND HAIR GROWTH. [Journ. Biol. Chem., 33, 1918, p. 313.]

The relation of variations in hair growth to thyroid disturbance has attracted the attention of clinicians for years, and the baldness occasionally developing in dysthyroid states is well known. There is a pig malady which causes loss of hair. This has been studied by these



authors who find that it is occasioned by a low iodine assimilation by either intestine or thyroid, resulting in a goitrous condition in both mother and young. It appears to be produced by rations with high protein levels and low laxative effects, with the accompanying condition of lack of exercise and unclean surroundings. It has been found possible to grow sows to maturity on natural feeding materials, but of relatively low protein content and good laxative properties with the production of normal offspring. On the other hand, these same feeds combined in different proportions and fortified with protein concentrates lead to the production of hairless pigs. The general use of iodine in the feed of all brood sows is therefore not yet to be advocated, except in regions where hairless pig production is endemic or persistent in character. These studies again call attention to the food factors in terms of definite chemical constituents rather than to the worthless pedantically scientific "calorie" standards which have been so long in vogue. [J.]

**Dziembowski, S. v.** ADIPOSE-GENITAL DYSTROPHY WITH MYOPATHY.  
[Deutsch. med. Wochschr., 1917. XLIII, p. 654.]

A mechanical dentist, 26, presented an adiposo-genital syndrome with myopathy. Many of his family were fat or neurotic. His right hand was injured at birth, which was prolonged and difficult. During childhood health good, but right hand weak: cramp and stiffness often in R. fingers. Right leg often stiff in walking. In his fifteenth year very severe headaches, and then he quickly became very fat. Adiposity increased greatly on face, shoulders, thorax, and belly; at times this was so rapid that the skin and its vessels burst, with bleeding. It troubled him for three years, and then became stationary. Then appeared polydipsia and polyuria. When 25, he noticed his testes were smaller than formerly, and erections and emissions became less frequent, and erotic desires weaker. During the last few months before admission increased weakness, especially on R. half of body. Hair on face and thorax scanty, on pubes of feminine type. Pelvis and hands feminine. Bitemporal hemianopia; other sense-organs and thyroid normal. Heart a little dilated, blood pressure low, lymphocytosis, sugar tolerance much increased. Internal viscera normal. A skiagram showed changes in sella. The myopathy was very marked, especially on R. side of body. An excised piece of biceps showed macroscopically excess of fat, and microscopically marked atrophy of its scanty muscle-bundles which were surrounded by very abundant adipose tissue. He was given injections of pituitrin and hypophysin twice daily. After fourteen days there was great improvement: weight fell  $4\frac{1}{2}$  kilos., lymphocytosis disappeared, blood pressure rose, the increased sugar tolerance quickly diminished, and the sexual functions showed daily improvement. Strength increased, he lost the tired feeling in limbs and the feeling of deadness. An increase of muscle tonus occurred. Muscular movements became

stronger, especially in hand-grips, and improvement in the facial musculature was very noticeable, and everywhere electrical reactions improved. The heart muscle shared in it, pulse became much slower, and the increase of pulse frequency after slight effort vanished. Treatment by extracts of thyroid, adrenals, and testes had no effect on patient's state. The writer regards the myopathy as undoubtedly a result of the pituitary hypofunction: the improvement in the symptoms of the adiposo-genital syndrome went hand in hand with that of the myopathy. He concludes that the pituitary secretion, supplied therapeutically, either acted directly on the musculature or activated the secretions of other glands.

LEONARD J. KIDD (London, England).

**Cramer, W., and McCall, R** CARBOHYDRATE METABOLISM AND THE THYROID. [Quarterly Jl. Exp. Physiol., Vol. 12, 1918, p. 81.]

In this third study dealing more directly with certain factors of gaseous metabolism in thyroidectomy the authors state that in rats removal of thyroid and parathyroids produces no severe metabolic disturbance; the power of the cells to oxidize carbohydrates is not impaired. They conclude that in experimental hyperthyroidism the condition of carbohydrate metabolism is not due to a direct stimulating effect of the thyroid hormone alone, which they state confirms views previously expressed by the authors to be found in their previous papers. [J.]

**Martelli, C.** ADIPOSUS DOLOROSA. [Tumori, 6, May 18, 1918, No. 1.]

Symmetrical painful subcutaneous lipomata accompanied by profound asthenia are characteristic of this condition. In the author's description the first lipoma developed about one month after an exceptionally violent effort to lift a heavy stone had been made. Dislocation of the shoulder resulted. Intense pain developed and the previously robust soldier grew weaker as more lipomas developed. They lay in the subcutaneous adipose tissue and were easily removed. Some upset in the balance of fat production took place, probably of endocrinous (?) [vegetative] origin. The author then develops an unnecessary toxic accumulation theory.

**Fournier, J. C. M.** HYPOTHYROID SYNDROME. [Revista Medica del Uruguay, April, 1918, 21, No. 4.]

A woman of 35 presented a complicated picture of dysthyroidism. Hereditary factors were present in the mother who had had cerebral hemiplegia from edema, as also two of her mother's brothers. The clinical history as of a succession of acute congestion affecting different tissues at different times resembling acute edemas. Operations which were performed showed the congestive nature of the morbid processes in bones, kidneys, intestines, etc. The various manifestations had been

diagnosed as subacute osteomyelitis, kidney stones, tuberculosis in bowels, kidneys or lungs, hysteric anuria, and syphilis of the nervous and cardiovascular systems. These disturbances began at 15 years of age. Thyroid medication arrested the hematuria, tendency to obesity, and somnolency, falling of the hair, angina pains and edema of the limbs. Acute hyperthermia accompanied the attack. The failure to recognize the hypothyroidism also permitted an advanced stage of arteriosclerosis to develop.

**Roux, C.** GOITER PROPHYLAXIS. [Corresp. bl. f. Schw. Aerzte, Vol. 48. 1918, March 23.]

The many studies of the epidemiology of goiter have brought out one fact that iodine applied at the right time, is the best treatment and that it is usually effectual, and without danger if given cautiously in the prevention of goiter. After the goiter has once developed enough to attract attention, it is usually too late for iodine to be of value as a prophylactic. It would be easy, says the author, to have a few crystals of iodine placed in an open jar in each schoolroom. The iodine vapor thus inhaled would be infinitesimal and no harm is apprehended, while during the school year it might act as effectually as the iodine inhaled during a month at the seashore, which has been thought to be efficacious. At the hospital and polyclinic in his charge, he distributes on every occasion small boxwood medallions containing a crystal of iodine in waxed paper. Without waiting for the etiology of goiter to be cleared up the marvellous and rapid action of preparations of iodine in homeopathic doses on the diffuse goiters of young pigs, young dogs and young children should be utilized in arresting the progress of the goiter and warding it off in others. The public and pharmacists should be warned of the dangers of improper iodine medication.

**Cramer, W.** (1) FURTHER OBSERVATIONS ON THE THYROID-ADRENAL APPARATUS. A HISTOCHEMICAL METHOD FOR THE DEMONSTRATION OF ADRENALIN GRANULES IN THE SUPRARENAL GLAND. (2) HISTOCHEMICAL OBSERVATIONS ON THE FUNCTIONAL ACTIVITY OF THE SUPRARENAL MEDULLA IN DIFFERENT PATHOLOGICAL CONDITIONS. [Proc. Physiol. Soc., J. Physiol., 1918, 52, viii-x, xiii-xv.]

The author has devised an ingenious method. He exposes for the histochemical demonstration of adrenalin granules, thin slices of the suprarenal body to the action of osmic acid vapor, by suspending the tissues for 1½ hours at 37° in a wet gauze bag in a closed tube containing 2 per cent osmic acid solution. The adrenalin granules stain a lustreless black and resemble coal-dust. After removal of the paraffin the section is placed in turpentine for 15 to 30 minutes to eliminate the fat. The injection of 2.5 m.  $\beta$ -tetrahydromaphthylamine into 20 mice caused a massive secretion of adrenalin granules into the blood during the first hour, and the medullary cells become almost depleted during

the second and third hours, but filled up again in the fourth and fifth hours, showing that the passing depletion is associated with increased secretory activity of the gland. Lasting depletion due to exhaustion of the gland occurs after the injection of the *vibrio septique* and after exposure to cold sufficient to lower the temperature of the animal. Increased activity of the gland was observed after severe hæmorrhage and after death from post-operative shock, and was probably an attempt to combat the low pressure. The statement that the load of adrenalin in the gland represents the balance between formation and secretion is confirmed. In conditions demanding the increased functional activity of the gland adrenalin granules appear in the cortex as well as the medulla. [Physiological abstracts.]

**Moschcowitz, E.** FOCAL NECROSIS OF THE ADRENAL: WITH REMARKS UPON ACUTE ADRENAL INSUFFICIENCY. [Proceedings of New York Pathological Society, October–December, 1917.]

Moschowitz describes two cases, the first occurring in a man forty-one years old. The most prominent symptoms were a subnormal temperature and slow respiration and pulse. Death followed three days after a nephrectomy for a pyonephrosis. Post mortem examination showed a number of sharply defined focal necroses scattered throughout the cortical zone of the right adrenal, with degeneration of cells, polynuclear infiltration, and moderate hemorrhage of the gland. Many of the capsular vessels were thrombosed, so that this thrombosis of the vessels may be a possible cause of the adrenal lesions. The second case was that of a child who had been sick for a long time with an abdominal ascites and chyluria. Autopsy examination showed bacterial emboli in the spleen, pancreas and kidney, and beneath the capsules of both adrenals, at places surrounded by a polynuclear infiltration. The patient had died from a streptococcemia of three days' duration. A review of the literature showed that acute inflammatory lesions in the adrenal were most common in some of the infectious diseases, as diphtheria, variola, typhoid, tetanus, pneumococcus infections, dysentery, and streptococcus infections. It may be obtained experimentally by injections of some of the pathogenic bacteria. Moschcowitz calls attention to the various and conflicting symptoms that have been described under the clinical aspects of acute adrenal insufficiency, and states that they do not correspond to what is known of the physiology of the gland.

## II. SENSORI-MOTOR NEUROLOGY

### 5. CEREBELLUM.

**Holmes, Gordon.** THE SYMPTOMS OF ACUTE CEREBELLAR INJURIES DUE TO GUNSHOT INJURIES. [Brain, XL, 1918, p. 461. Clev. Medical J1.]

The effects of cerebellar injury fall almost exclusively on the motor system. In the early stages one of the most prominent symptoms is loss or diminution of tone in the muscles of the same side of the body as the injury. The involved muscles feel flabby to the examiner and are more easily displaced transversely and compressed. They can be stretched to a greater extent without discomfort to the patient. Not infrequently the hand will be observed lying for long periods prone on the bed with the fingers hyperextended in a seemingly very uncomfortable position. If both forearms are held vertically by the observer, the wrist on the effected side usually falls passively into a position of extreme flexion, while in the normal limb the wrist is not allowed to become more than semiflexed. There is definitely less resistance to passive motion. The joints swing free until they are suddenly locked by their bony and ligamentous structures. If the arm is held out horizontally and is gently tapped, the well arm is only moderately displaced and immediately resumes its former position; while the affected arm offers less resistance to displacement, is arrested less abruptly, and is slower in its return to its former position.

There are certain disturbances of voluntary movement as asthenia, ataxia, the rebound phenomenon and adiadochokinesis. The asthenia is shown by the feebleness of voluntary acts. Dynamometric measurements show a marked difference in the two sides. The affected limb tires more easily. Often, as in walking, there is a sudden giving way of the limb. There is an unconscious reluctance to use the affected limb where choice is presented. The movements are slow, which may be apparent when weakness cannot be made out. This slowness affects both initiation of the movement and its development to its maximum, delays relaxation both in its initiation and completion. The weakness generally diminishes gradually. Cerebellar weakness is distinguished from that of cerebral-cortical or cortico-spinal tract origin by the uniform and approximately equal affection of all groups of muscles by the fact that while all muscle voluntary movements are weak, none are limited in range, by the absence of the characteristic alterations in the reflexes and by the fact that there are no contractures or rigidities. Ataxia resolves itself into several components: decomposition of movement, asynergia, dysmetria, tremor and deviations from the line of movement. Decomposition of movement: If we ask a patient to lie in bed and extend his arm vertically over his face and then bring his forefinger to his nose, it is seen that instead of depressing his arm and flexing his elbow

simultaneously, he first brings his elbow towards the bed, and only when it is there does he approach his finger to his nose. In other words, he decomposes the movement. He performs the separate movements that constitute an act by "numbers," as in a gymnasium. Asynergia refers to the disturbance of the proper synergic association in the contraction of agonists, antagonists and fixating muscles. For example, when the fingers are flexed the extensors of the wrist normally contract synergically with appropriate force in order to prevent simultaneous flexion of the wrist, but if a patient with a cerebellar lesion grasps a small object quickly, it often happens that the wrist of the affected side is extended excessively or too early, so that the hand is bent backwards when the fingers are but half flexed. Dysmetria denotes that the range and force of the movement are not proportional to their aim, e. g., in bringing the finger to the nose it either shoots past or stops too soon.

Tremor is more common in the later stages; it may be completely absent in the early stages. Deviations from the line of movement is important and has often been overlooked. As the limb is raised it sways, deviates from its proper course, and towards its completion does not come straight to its object. One patient would bring food to his ear. Another was afraid to smoke, holding the cigarette in the affected hand, because he would tend to get the cigarette in his eye. The rebound phenomenon. The patient's elbows are supported on a table and he is asked to pull each hand in succession towards his mouth, against resistance offered by the observer who grasps his wrists; when this resistance is suddenly released the hand of the affected side flies to his mouth or shoulder, often with considerable violence, but the movement of the normal limb is arrested almost immediately by contraction of the antagonists, and may even jerk back or rebound. As a rule this phenomenon is equally pronounced at other joints. It is more pronounced in the early cases, and when the hypotonia is greatest.

Adiadocokinesis. A patient with cerebellar disease is almost always unable to execute alternate movements rapidly. It may be tested at any joint where normally such movements are performed as flexion and extension, pronation and supination, etc. Holmes has never observed static tremor where there is full relaxation and support, but it may be simulated where the posture assumed requires muscular contraction. In sitting or standing there may be tremor of the head, or the whole body may sway. After the arms, e. g., are once outstretched they often are held with less tremor than the sound limb, i. e., until they get tired, which they do early. Giddiness is extremely common after gunshot injuries of any region of the head. Seventeen cerebellar cases described apparent displacement of self, or of external objects, or both (12). The vertigo rarely persisted for more than one or two days. In almost all of the cases the subjective and objective rotation were in the same direction. Where actual movement accompanied the sensation, it took place from the affected toward the sound side. Spontaneous deviation

of the limbs and Barany's test. The patient is asked to hold both arms extended horizontally in front of him and to close his eyes. Then in the majority of cases the homolateral limb swings either abruptly or slowly away from the symmetrical position and comes to rest gradually. This occurred in all the unilateral cases in which it was looked for. Barany's pointing tests confirm these observations. The patient's forefinger is placed in contact with some fixed object held at some distance from the bed. He is then asked, while his eyes are closed, to bring his finger down slowly to the bed and then back again to the object. On the affected side the finger deviates constantly, and this deviation increases for a time if the test is continued. Tested in the horizontal plane the deviations are much less constant. Abnormal attitudes, which are such a prominent feature in animals after experimental ablation of portions of the cerebellum, are much less constant and striking in man. As a rule the head tends to be flexed towards the side of the wound and rotated towards the opposite side, so that the chin approaches the contralateral shoulder, and the occiput is approximated towards the shoulder of the affected side. The trunk is often concave to the side of the lesion, and there may be a tendency to rotate to the unaffected side. The flaccid and hypotonic limbs generally assume any posture into which they happen to fall or are moved. Placed on his feet the patient is shaky, uncertain and unsteady, his whole body sways irregularly, his head oscillates, and usually he tends to fall towards the side of the wound and backward. It often seems as if he were impelled to that side, as though by an invisible hand. His attitude is striking—his head and trunk are inclined to the injured side, his spine is concave to it, but his pelvis is so tilted that his weight falls chiefly on the sound foot. The homolateral foot is usually abducted and sometimes rotated outwards. His whole body is held stiff and rigid. If gently pushed he can be more easily pushed to the side of the lesion, and he makes less appropriate effort so save himself from falling. It must be emphasized that the patient can stand as securely with his eyes closed as when they are open; i. e., there is no tendency to Romberg's sign. On walking he has much difficulty in preserving equilibrium. He fears to trust himself on the affected leg. He throws his weight on it cautiously and slowly and hurries off of it by quickly bringing up the other leg. He tends to stumble to the homolateral side, and in trying to walk a straight line, deviates to the affected side. If a chair is placed at his injured side, he walks around it in a closing spiral; if placed to the sound side, he will walk in an opening spiral. Ocular movements and nystagmus. For the first few days the eyes are deviated to the opposite side, especially if the patient is unconscious. The range of motion is usually limited on attempted conjugate motion towards the injured side. Skew-deviation was observed in five cases. Nystagmus is present in almost every case. It can be seen usually only if the patient fixes an object. Looking at an object held in front of him his eyes tend to deviate towards the

unaffected side slowly, and are brought back to the middle line by sharp jerks of small range. It is on looking to the injured side that the nystagmus is most marked, with wide slow deviations to the rest point, and forcible jerks of wide amplitude, slow in rate, and regular in rhythm, to the object held on the injured side. On convergence both eyes tend away from the lesion, and come back with irregular jerks. Nystagmus persists for weeks and months. Speech is abnormal in most cases in which the lesions are severe and recent; it is usually slow, drawing, and tends to be staccato and scanning. It is sing-song and difficult to understand. The attempt to utter a series of syllables is associated with excessive facial grimacing. The reflexes. Striking alterations in the reflexes are not prominent or obvious to clinical observation. Tracings on a smoked drum show that the knee jerk has no prolongation of its latent period. In the normal curve the fall of the leg is slower than the rise, due to the action of the extensor muscles. In cerebellar injury the fall is the more rapid phase. Also the falling limb acquires sufficient velocity to give it a number of oscillations which have all the features of those of a pendulum. The normally palpable contraction of the hamstring tendons cannot be felt. Holmes has never found a disturbance of any modality of sensation and he concludes that no form of sensation is disturbed.

**Léri, André.** CEREBELLAR LOCALIZATIONS IN MAN: A COMPLETE CEREBELLAR PARASYNDROME DUE TO A WOUND OF THE INFERIOR VERMIS (the Syndromes of Duchenne and of Babinski, associated and limited to the lower limbs). [*Bull. de l'Acad. de Méd.*, 1917, 3 Sér., LXXVII, p. 596.]

A man of 31 was wounded in the neck by two bullets: one was superficial in the left occipital region, the other deeper just to left of middle line. There was opisthotonus which soon passed off, and gradual improvement in gait. Six weeks later examination showed Duchenne's cerebellar syndrome, titubation, antero-posterior tremor of lower limbs, and vertigo, with tendency to inclination to left in antero-posterior displacements of the head. There was also the syndrome of Babinski, viz., typical *asynergia* and *adiadocokinesia* of lower limbs, with some degree of cerebellar catalepsy, but no hypermetria; no atomia, ataxia, or objective sensory changes; lower limb reflexes brisk, especially on R. In a few months almost entire clearing up of all these symptoms. The writer concludes that a superficial lesion of the inferior vermis can give most of the symptoms of the two cerebellar syndromes of Duchenne and Babinski respectively; and that in the upper or middle part of the inferior vermis there is a center for coördination of the lower limbs. He also claims that an analysis of his patient's symptoms justifies the following conclusions: (1) Titubation is totally independent of atonia and asthenia, and also of vertigo. (2) *Asynergia*, *adiadocokinesia*, and tremor can be produced without any excessive movement; hypermetria,



which is one of the important elements of Babinski's syndrome, is therefore not the determining and necessary case of asynergia, adiadococinesia, and tremor; and it is wrong to attribute these symptoms, as some writers have done, to dysmetria or hypermetria. (3) Vertigo, of cerebellar origin, can be the consequence of displacement of the head in a single direction, e. g., the sagittal; it seems therefore probable that the cerebellar cortex has distinct relations with each of the semicircular canals. (4) Opisthotonus can follow a lesion of the inferior vermis of man, as of an animal.

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## 6. MENINGES AND BRAIN.

**Bushnell, L. D.** BACTERIOLOGICAL EXAMINATION FOR MENINGOCOCCUS CARRIERS. [Journal of Medical Research, March, 1918.]

Bushnell brings out some very well known, but often neglected, points of interest to the general practitioner which may make the difference between success and failure in identifying meningococcus carriers. As soon as the swab is taken it should be planted on the media on which it is to be cultivated, and not carried around for any longer time than is absolutely necessary before being taken to the laboratory. The use of the West swab was discontinued, as the swab itself was considered unsatisfactory. The streaking method is particularly helpful in the isolation of the microorganism. The media used was a two per cent. meat infusion agar to which had been added one per cent. peptone, 0.5 per cent. glucose, and five per cent. defibrinated sheep's blood. Full directions are given for its preparation, and for that of the stains used. The plates may be examined in about twenty hours, and better results are obtained when they are warmed before use. The type of colony, the method of staining, and the agglutination reactions are described in detail. The organization of an ordinary laboratory staff so that 500 examinations are made in a day is something of a problem, which was solved by the following assignment of work: two helpers washed and sterilized glassware and made and sterilized swabs; one person made media, poured plates and made stains of colonies; one examined plates, studied microscopic preparations and made the agglutination tests; one took swabs and smeared them on the plates; another streaked the plates with the needle, and still another took the names and numbered the plates with the corresponding number. The carriers were isolated and treated with a spray of an oil solution of dichloramine-T. Of the persons examined, 2.52 per cent. of the normal population were found to be carriers.

**Aievoli, E.** COMPLICATIONS OF BRAIN WOUNDS. [Rif. Med., Vol. 34, 1918, No. 20.]

Recent literature on brain wounds are analyzed by the author. They are drawn from a total of 2,357 British and 6,664 French cases. Tran-

sient cerebral symptoms are the rule, but as a rule a wound sufficiently severe to require trephining often leaves the patient with reduced mental capacity. Symptoms ranging from headache to vertigo, from asthenia to amnesia, with diminished power of attention and association of ideas, and exaggerated emotivity are frequent. Papilledema, hypertension, abnormal albumin content of the cerebrospinal fluid, and labyrinth disturbances are frequent. Tuffier in his statistics shows only 0.64 per cent. cases of serious mental impairment. The outlook is more favorable with hemiplegia from injury of the prefrontal lobe and the Rolandic region and vicinity. Gradual restitution of function is the rule.

**Sicard, Dambrin, and Roger.** CRANIAL BONE PLATES IN CRANIOPLASTY.

[Bulletin de l'Académie de médecine, April 30, 1918.]

These authors have been resorting successfully to this procedure for two years, and have now operated in eighty-five cases without mortality, with perfect tolerance of the bone plate, and with excellent esthetic and protective results. The plate is obtained from a human cadaver at autopsy and is taken from the corresponding region of the skull. It is properly shaped, thinned down, then freed of fat and sterilized. The few persistent local sinuses and complications necessitating removal of the plate in three or four of the earlier cases were entirely obviated by strict technic in the latter portion of the series. Of the other methods hitherto used, metallic plates are open to the objection of ultimately inducing local irritation. Cartilage and osteoperiosteal plates sometimes give way and become absorbed, even to the point of reappearance of the cerebral pulsations. Cartilage plates placed in blood or blood serum for a few hours show marked changes in curvature. Bone plates, on the other hand, promote subjacent osteogenesis, or rather, fibrogenesis. While they are similarly susceptible to absorption, there remain locally very firm fibrous or osteofibrous residua which continue to serve the purpose of the plate.

**Elsberg, Chas. A.** RUPTURE OF ANEURISM OF MIDDLE CEREBRAL ARTERY.

[Neurological Bulletin, Vol. I, No. 5, 1918.]

The patient, after a sudden attack of sharp head pain, dizziness and faintness, lay in a stupor a number of hours. On recovering consciousness he complained of diplopia, his neck was stiff and he had a positive Kernig. Two weeks later on admission to the New York Neurological Institute, he complained of headache, rigidity of the neck, inability to walk and general prostration. Facial innervation was equal, no ocular palsies, pupils equal, moderately dilated, responded sluggishly to light. Fundi showed beginning papilledema right and left. Tongue protruded in straight line, sense of smell normal right and left. Power in upper extremities was good, reflexes somewhat exaggerated equally right and left. No ataxia or incoördination. Power in lower extremities was normal, knee jerks sluggish, ankle jerks unobtainable, no Babinski or

other pathological reflex. Three weeks after the beginning of the symptoms he complained of blurring of vision in right eye, and began to have irregular fever up to 101° F.; left knee-jerk was livelier than right, abdominal reflexes diminished on right, right pupil widely dilated and unresponsive to light; left pupil reacted to light and accommodation. Papilledema of two diopters in right eye and slight swelling of left optic disc; it was fairly certain that vision in the nasal half of the right visual field was lost. The same night the patient had a convulsion involving the left arm, left leg, and both sides of the face. Shortly afterwards he lapsed into a semi-comatose state. Diagnosis lay between tumor near the lateral ventricle with hemorrhage, and a ruptured aneurism in the anterior or middle cranial fossa on the right side. A bilateral subtemporal decompression was performed. On the right when the dura, which was plum colored, was incised, a considerable amount of old fluid blood and clots were evacuated. Exploration failed to locate source of hemorrhage. No fluid obtained on puncture of right lateral ventricle. On the left dura and cortex were normal, aspiration of left lateral ventricle withdrew a considerable amount of bloody cerebrospinal fluid. The patient died in coma eight hours after operation. Autopsy showed the right cerebral hemisphere especially over the frontal, temporal and parietal lobes to be covered by some old fluid blood and clots; no blood over convexity of left hemisphere. Under surface of right frontal lobe was covered by an old blood clot. In the horizontal portion of the Sylvian fissure near the median line, and impinging on the right optic tract was a small aneurismal mass the size of a cherry, connected with the middle cerebral artery near its origin. Dissection showed it to be an aneurismal sac derived from the middle cerebral artery which had ruptured into the frontal lobe and caused a collection of blood in the lobe. The mass of blood had ruptured through the basilar surface of the lobe and spread over the right hemisphere. The right lateral and the third ventricle were distended with blood clot; the left lateral ventricle contained thin bloody fluid.

JEAN STAIR.

**Guillain, G.** MENINGEAL HEMORRHAGE IN WAR PRACTICE. [Bulletin de l'Académie de médecine, April 2, 1918.]

In penetrating wounds of the skull, nearly all the primary symptoms, as well as the immediate prognosis, are dependent upon meningeal hemorrhage. Indications of it are early coma, epileptiform seizures on the first day, pupillary disturbances, bradycardia, and hyperthermia. In all cases of penetrating skull injury which succumbed to shock the author noted both clinically and at the autopsy the presence of meningeal hemorrhage. Inhalation anesthesia and lumbar puncture are attended with danger under such circumstances. Even in simple contusions of the skull, without fracture, due to war projectiles, meningeal hemorrhage is much more frequent than is generally supposed. It is

marked by slight mental confusion, headache, slow pulse, anisocoria, etc.; lumbar puncture yields a pinkish or yellowish cerebrospinal fluid. Subdural hematoma may follow; yet its clinical signs—blindness, hemianopsia, aphasia, paralyses, etc.—may later completely disappear, either spontaneously or after repeated lumbar punctures. In 1915 attention was called by the author to meningeal hemorrhage from nearby explosive detonations, in the absence of an actual wound. In addition to the frequently present diagnostic signs of meningeal hemorrhage, viz., headache, neck rigidity, Kernig's sign, bradycardia, etc., Guillain finds diagnostically significant a state of cerebral excitation with mental confusion, the contralateral flexion reflex by pressure on the femoral quadriceps, true defensive reflexes such as those of the frog, and pupil disturbances. In a few cases there was noted a massive albuminuria or a cholemic tint of the skin.

**Rawling, L. B.** CEREBRAL EDEMA. [British Medical Journal, May 4, 1918.]

The author has seen a considerable number of cases presenting evidences of cerebral edema as the result of heat stroke, cerebral malaria, shell shock, etc., and has come to the belief that the condition is due in part to a damage to the veins of the brain and its membranes which reduces their capacity for absorbing the excess of exuded fluid. Lumbar puncture sometimes temporarily reduces the symptoms of the increased intracranial pressure, but at other times it proves of no value, or even yields no excess of fluid, probably due to the blocking of the communication between the brain and cord. The most satisfactory form of treatment has been the performance of a subtemporal decompression with incision crucially through the dura and followed by replacement of the temporal muscle. This permits the escape of the fluid into tissues whence it can readily be absorbed and after some time the normal functions of the cerebral sinuses and veins are restored. In practically all of the cases in which this operation has been performed by the author the results have been very good and quite permanent. The operation is not dangerous and is recommended for all severe cases in which improvement has not taken place after three months of medical treatment.

**Netter, A.** EPIDEMIC ENCEPHALITIS WITH LETHARGY. [Bulletin de l'Académie de médecine, May 7, 1918.]

The author reports on a series of seventy-one recent cases of this combination, comprising thirty-seven in England and thirty-four in France, with fifteen personal cases. The patient develops fever, headache, and at times vomiting. Almost immediately there is marked lassitude and somnolence. At first the patient can be momentarily roused from his slumbers, but later the condition passes into an actual coma, occasionally interrupted by delirium and restlessness. Very characteristic are the ocular disturbances, usually bilateral, consisting of ptosis,

strabismus, immobility of the eyeball, or nystagmus. The intrinsic ocular muscles are less frequently involved, but paralysis of accommodation and a sluggish light reflex have been observed. The muscles innervated by the facial and those of the tongue, larynx, and extremities may participate in the paralysis. Tremor is not exceptional. The characteristic signs of meningitis, Kernig, rigidity, and pulse irregularity are lacking or but slightly marked. The meningitic line is, on the other hand, constant. Lumbar puncture yields a clear fluid, under normal pressure, without excess of albumin, and with a normal or but slightly augmented cell content. Of fifteen patients, seven died. Death or recovery may occur within a few days, but generally the disease persists through weeks or months. Lassitude and the eye disturbances continue for some time during convalescence. Postmortem examination shows but little macroscopically; microscopically there are chiefly perivascular infiltrations, most marked about the nuclei of the motor nerves of the eye, in the pons, medulla, and gray substance of the ventricular walls. The spinal cord is but little involved. While manifestly similar to epidemic poliomyelitis, lethargic encephalitis arises from a different cause. The symptoms cannot be held due to alimentary intoxication, e. g., botulism. The cases always occur singly, whereas in botulism several members of a family become victims. An identical epidemic occurred last year in Vienna. Wiesner thinks he has succeeded in transmitting the disease to the monkey by subdural inoculation and in isolating the causative germ as a Gram positive coccus. The disease must, like poliomyelitis, be propagated by germ carriers in good health or affected only with a slight catarrhal form. Probably injections of serum from convalescents, administered early, will here also prove of therapeutic service.

**Leri, A.** MALARIAL HEMIPLEGIA. [Bull. et Men. Soc. Hop., Vol. 34, March 7, 1918, p. 210.]

These patients had a severe somatic hemiplegia. The histories of five are given and a review of the literature. They ranged from 48 to 21 years of age. The producing lesion in three apparently was an aortitis set up by the malarial organism, which gave rise to embolism of the cerebral vessels. In the other two cases a malarial enteritis with consequent thromboses.

**Starr, M. A.** DOUBLE PRIMARY ATHETOSIS. [Neurological Bulletin, Vol. I, 5, 1918.]

The symptoms in this case consisted of constant irregular spontaneous movements involving the face, tongue and upper and lower extremities, of weakness of the neck and back muscles and marked kyphosis without rigidity. The muscles were well nourished, not atrophied, and reacted normally to electricity. Reflexes slightly exaggerated, but no Babinski nor clonus. Sensibility everywhere perfect.

Sight, hearing, smell and taste normal. Mental condition one of a mild grade of imbecility. Starr concludes that athetosis manifests itself under two conditions. One, represented by his report, is a rare, possibly family form, primary, spontaneous, and generally bilateral. In such cases there is no paralysis and no disturbance of sensation. This seems to show that the origin of the spasmodic movements is some abnormal sensation sent up to the cortex and acting reflexly. He believes the movements are cortical in character, as they are more or less coördinated and apparently like movements with a voluntary purpose. They are decidedly not choreic, nor like the movements occurring in the tics. They also differ wholly from the movements of myoclorus, being slower and more diffuse, and they lack the rhythmical rotary movements occurring in the feeble-minded. The pathology of this form of double spontaneous athetosis is uncertain, but evidence seems to point to lesion of the lenticula, such localization confirming what the character of the movement seems to indicate—that the functional state of the cortex is good. The second form of athetosis is the more common, is unilateral in form, of the variety occurring in infantile hemiplegia. It is secondary to brain lesion, though such lesion does not appear to have any uniform location. The pathological origin of the athetosis is therefore still a matter of doubt. It is rarely if ever a symptom of tumor in the sensory or motor cerebral cortex, and does not result from meningeal inflammation. Subcortical cerebral cyst, old cicatrices, a result of hemorrhage or softening in the thalamus, in the lenticula, in the red nucleus of the tegmentum in the superior cerebellar peduncle, in the inferior cerebellar peduncle, and in the body of the pons have all been found in unilateral athetosis. If the lesion in athetosis is lenticular, is it present in Wilson's disease, which is caused by disease of this nucleus? In the few cases of Wilson's disease observed by Starr, athetosis was absent. There appears to be no treatment for the athetosis.

JEAN STAIR.

**Taft, A. E.** FOCAL AND GENERAL UNILATERAL BRAIN ATROPHY: EFFECTS UPON THE CORPUS CALLOSUM. [Review of Neurology and Psychiatry, Vol. XIV, No. 6.]

Five cases are considered, all of which were hemiplegic, epileptic, and mentally defective. The onset in these cases was between the second and eighth year. Examination of the brains in every case shows a lesion of one hemisphere; focal in three cases, and involving the entire hemisphere in two. The location and extent of the cortical defect is indicated by an exactly corresponding thinness of the corpus callosum. The material was derived from the Monson State Hospital, and analyzed anatomically and by means of photographs, with the aid of the Massachusetts State Board of Insanity. Since our knowledge of the exact location of the cells of origin and the terminal arborizations of the

corpus callosum fibers is at the present time very slight, it is clear that such a study as this may finally add to our knowledge of a very important problem—the physiology of the commissural system. The results of this study incline the writer to agree with von Monakow and others, that the parts of the callosum unite symmetrical areas of the cortex, rather than with Cajal, who believes that the corpus callosum is much more complex, and unites dissimilar areas. It may be that the corpus callosum does, by means of collaterals, effectively unite dissimilar areas of the hemispheres.

C. E. ATWOOD.

**Lhermitte, J., and Claude, H.** THE INFUNDIBULAR SYNDROME IN A CASE OF TUMOR OF THE THIRD VENTRICLE. [*Presse Méd.*, 1917, Ann. 25, p. 417.]

A man of 25, who had a chance at 20, was treated for four months in April, 1916, for anemia; came to the writers in September, 1916, being then ill, wasted, pale and weak; he had had anorexia for many months. Pronounced asthenia, bad sleep, polydipsia, polyuria, but no polyphagia or glycosuria. Spleen seemed slightly enlarged. Progressive amblyopia. Lumbar puncture showed a clear fluid under slight hypertension, containing 0.56 of albumen and numerous lymphocytes. Typical complete bi-temporal hemianopia. Nasal half of each iris was pale, especially L. Both pupillary reflexes diminished, L. barely perceptible. Pupils varied greatly in size, sometimes very large, at others very small. After a few days of intensive specific treatment, pulse became arrhythmic, with extra systoles at times. After eight days of this treatment articulation became slow, scanning, drawling, and monotonous; these symptoms disappeared soon after cessation of this treatment. On October 23 patient fell into profound sleep from which he could not be roused; this narcolepsy lasted five hours, and left him amnesic and astonished. Memory was poor for a short time, and improved soon after the narcoleptic attack. On November 26 cardio-vascular symptoms returned, with pulse 136 of embryonic type and feebleness of heart-beats. On November 30 blindness. The polyuria persisted, 2½ to 3 liters in 24 hours. On December 26 great cachexia, with signs of tuberculosis at right pulmonary apex, and a confusional delirium with a dreamy state ("onirisme"). There was disorientation in time and space, and euphoria. No marked changes up to his death on February 17, 1917.

Necropsy showed a fluctuating, retro-chiasmatic, violet swelling. Pituitary normal, also the sella; it was not apparently compressed. Inner part of optic tracts flattened. Histological examination showed a cystic epithelial tumor in connection with the third ventricle; the tumors had distended it, and had thinned out especially its inferior segment, the infundibulum, and the lamina terminalis, but had entirely spared the pituitary. Slightly distended lateral ventricles; no meningeal

or vascular changes. The writers discuss their interesting case with reference to the recent experimental work of Aschner and of Camus and Roussy. In man, as in dogs, lesions of the ventral part of the third ventricle may be accompanied by profound disturbances of the circulation and of the regulating mechanism of the hydration of the tissues. In the production of these phenomena the pituitary has but an indirect rôle. As to the nature of these centers in the infundibulum or the tuber cinereum, only hypotheses can at present be offered. But the facts of the writers' case and of the experiments named speak in favor of the theory of modern anatomists that there is a series of visceral centers, arranged at intervals from bulb to infundibulum, whose action radiates over the whole of the vegetative nervous system. The writers mention that Aschner found that puncture of the floor of the third ventricle provoked an acute glycosuria in animals. They explain the absence of glycosuria in their own case partly by the fact that the nutritional state of the patient was very unfavorable for its appearance, and partly by the limitation of the neoplasm.

LEONARD J. KIDD (London, England).

**Elsberg, Chas. A.** MYXOSARCOMA OF TEMPORAL BONE. [Neurological Bulletin, Vol. I, 5, 1918.]

The patient had a somewhat extended history of various illnesses in all of which the left side of the body, and especially the cranial nerves of the left side, were affected. The first of these illnesses began when the patient was four years old, when an attack of small-pox followed by oritis, left behind a paralysis and atrophy of the left side of the tongue and diminished hearing in the left ear. At the age of thirty-three a post-partum attack—probably one of cerebral embolism—added a paresis of the left side of the face and a weakness of the left arm with paralysis of the left vocal cord. Some years later after removal of glands of the left side of the neck, a branch of the left facial nerve was found to be completely paralyzed (ramus marginalis mandibulae). Finally the patient developed symptoms which were clearly referable to the left lobe of the cerebellum and the left posterior fossa—ataxia, nystagmus, adiadochokinesis, hypesthesia over the distribution of the left trigeminus, complete paralysis of the left facial, complete nerve deafness in the left ear, and loss of the normal caloric reactions on that side. The case was diagnosed as tumor in the left cerebellopontine angle, and an operation performed. On exposure of the dura covering the lower part of the left hemisphere considerable yellow gelatinous material began to extrude from the left posterior fossa, and on depressing the dura, the left posterior fossa was found to be entirely filled by this material. Considerable of the gelatinous material was removed, and was found on examination to be of the nature of a myxosarcoma. The patient died ten days after the operation. Cranial autopsy showed the brain of normal size and shape. There was moderate distension of the third and lateral ventricles. Right cerebellar lobe was normal. The



left side of the pons and medulla and the left cerebellar lobe were deeply indented by a large tumor mass of gelatinous consistency which entirely filled the posterior fossa on the left side between the dura and the bone. At one spot the growth had perforated the dura and a second tumor mass lay against the pons and medulla inside of the dura. Removal of the brain the petrous portion of the left temporal bone was found almost entirely destroyed by the tumor, only a thin shell of bone remaining. The tumor had evidently originated in the petrous portion of the left temporal bone, had perforated the bone, and filled the posterior fossa on the left side. A moderate foraminal depression on both lobes of the cerebellum showed there had been a protrusion of the cerebellum into the foramen magnum, which explained the sudden medullary death of the patient.

JEAN STAIR.

**Sabrazès, J.** TENTACULAR GLIOSARCOMA OF THE CORPUS CALLOSUM. [*Gaz. Hebdomadaire des Sciences Médicales de Bordeaux*, 1918, XXXIX, p. 25.]

A gliosarcoma of the corpus callosum which extended, by tentacle-like expansions, forward into both hemispheres. A woman, 52, was admitted on January 24, 1913, and died four days later. For four years she had had paroxysmal frontal headache, rather worse on right side. Her intelligence seems to have been always very mediocre. In 1909, uncertain and titubating gait, obstinate constipation, boulimia, exaggerated thirst; and gradually psychical symptoms developed in the shape of a disaccord between her words and her actions. There was apraxia. She could not take care of herself. Increasing amnesia, verbal confusion, and disorientation in space. She then lapsed into chronic mental confusion, could not converse, and gave erroneous and contradictory answers. Two years later (August, 1911), when very feeble in mind and body, she had a stroke which left her lower limbs paralyzed; the left, and then the right lower limb became contracted, the flexion of the fingers on the palm producing ulcerations. Sensibility to prick apparently blunted on both sides. She lay in right lateral decubitus, with thigh and leg flexed but mobile, and not contracted on this side. She never complained, and was indifferent to everything. A month before admission in 1913 she spoke no more, and neither ate nor drank spontaneously. She passed excreta in bed. She had large bedsores in numerous places, with fever, stiffness, and mental clouding. She could not be made to put out her tongue. Urine albuminous, with skatol reaction and slight excess of indican. Flaccid paralysis. Articular sensibility to limb-displacements was preserved, and was even increased on left. Lively reflexes, with Babinski positive on L., doubtful on R. She died from the infection of her multiple bedsores in a state of cardiopulmonary collapse. Necropsy: a gliosarcoma of anterior region of corpus callosum extending into both hemispheres. In the left hemisphere the genu of the callosum is invaded by the tumor which at this level is of the size of a chestnut. It extends along the roof of the

lateral ventricle, invades the lenticular nucleus, upper part of the thalamus, and internal capsule; above, it fuses with the caudate nucleus, and extends into the centrum ovale; it almost reaches the cortex cerebri at the foot of the second frontal. The tumor is flabby, and has holes in it like those of Gruyère cheese; it shows no hemorrhagic foci. It sends a polypiform prolongation into the lateral ventricle. From the left hemisphere the tumor passes into the right, infiltrating the septum lucidum, and involving the lenticular nucleus, internal capsule, and upper part of thalamus. Degeneration of both pyramidal tracts. The writer has some remarks on the symptomatology of callosum tumors, and the variable nature of the symptoms according to the part of it affected. A lesion of its genu gives mental symptoms, with apraxia, disturbance of the association of ideas and in the comprehension and proper use of words. In the writer's case there was absence of visual and eye-ground changes, and preservation of pupillary reflexes.

LEONARD J. KIDD (London, England).

**Clarke, Frederick B.** A STUDY OF THE ANATOMICAL LOCATION AND HISTOPATHOLOGY OF NINETY-NINE BRAIN TUMORS. [Review of *Neurology and Psychiatry*, Vol. XIV, No. 11.]

The tumors were collected chiefly from the hospital services of Drs. Spiller, Mills and Frazier, and the greater number have been described in the literature. They are classified in the article, as to region involved and nature, into gliomata and ependymomata; endotheliomata; sarcomata; gummata and tuberculomata; carcinomata; tumors of the third ventricle; tumors of the fourth ventricle; tumors from mesoblastic and epiblastic tissue; intra- and extra-cerebellar tumors.

The location of the tumors is tabulated as follows:

	Glioma	Ependymomata	Glia-Sarcoma	Endothelioma	Perithelioma	Hemangio-Perithelioma	Carcinoma	Tuberculoma	Gumma	Sarcoma	Blood Cyst	Total
Frontal.....	5	..	1	4	1	..	..	3	..	..	..	14
Peri-and post-central convolutions..	5	..	..	3	..	..	..	2	2	1	..	13
Temporal.....	3	..	..	4	..	..	1	..	1	1	..	10
Parietal.....	3	..	..	2	1	..	..	..	..	2	..	8
Occipital.....	3	..	..	1	..	..	..	..	..	..	..	4
Optic thalamus.....	2	..	..	..	..	..	1	..	..	..	..	3
Lenticular nucleus.....	3	..	..	1	..	..	..	..	..	..	..	4
Third ventricle.....	2	..	..	..	..	..	..	..	..	..	..	2
Mesencephalon.....	..	..	..	1	..	..	..	..	..	..	..	1
Pons and medulla.....	4	..	..	..	..	..	..	2	..	..	..	6
Cerebral peduncle.....	1	..	..	..	..	..	..	..	..	..	..	1
Cerebellum.....	2	..	..	..	..	..	..	1	..	..	..	3
Fourth ventricle.....	2	3	..	1	..	..	..	..	..	..	..	6
Extra-cerebellar.....	..	..	..	17	..	..	..	..	..	..	1	18
Pituitary body.....	..	..	..	..	..	..	3	..	..	..	..	3
Multiple locations.....	..	..	..	..	..	1	2	..	..	..	..	3
Total.....	35	3	1	34	2	1	7	5	6	4	1	99

In speaking of tumors from mesoblastic and epiblastic tissue, the writer states that the cells from mesoblastic origin present a well-marked tendency to annulation, and well-marked whorls are constant, and predominate in various fields, suggesting an endothelioma; however, in some sections these annulations of connective tissue origin entirely surround groups of cells which are not of the same type. In other areas the two types of cells are sharply defined from each other. Still other areas show the two types of cells closely intermingling with each other.

The cells of mesothelial origin present various types, the predominating cell being of a large spindle shape, with but scant protoplasm, although many of the cells are round, being both large and small in type.

The cells of glial origin are for the most part large, with varying amount of protoplasm and little tendency to fibril formation. They show an intense activity and both types of cell division are seen.

As regards cerebellar tumors, a predilection for the left side was found in eleven of the nineteen extra-cerebellar and in both of the intra-cerebellar growths involving a lateral lobe.

In new growths of the cerebrum the increase in size of the hemisphere containing the tumor, out of proportion to the increase in bulk produced by the addition of the tumor, is due to neuroglial proliferation in the cerebral tissue. The glia cells were small, with no greater amount of protoplasm than in normal. There was but little evidence of involvement of the vessels. Several tumors other than glioma were studied to determine gliosis, with the result that it was frequently found in variable degree.

In sixty-six tumors twenty-nine were examined for hydrocephalus, with the result that some degree of dilatation was present in thirteen.

Of the thirty-three sub-tentorial tumors, eighteen were extra-cerebellar. Eleven could be examined for hydrocephalus, with the result that seven showed some dilatation of the ventricles.

Of the four tumors involving the pons, three could be examined, and slight enlargement of the right posterior horn of the lateral ventricle found.

In tumors developing within the cerebellum, of which there were nine, and seven examined, six showed hydrocephalus in some degree. Hydrocephalus may not be uniform in the third and lateral ventricles, and it is of interest and importance to note that: (1) The lateral ventricles may be enlarged, the third remaining normal; (2) the third ventricle may be enlarged, and the lateral remain normal; (3) the third ventricle may remain normal, and both posterior horns of the laterals may be dilated; (4) the lateral ventricle of one side may show greater dilatation than the other, and the greater dilatation may be on the same side as the tumor, as was the case in two specimens.

An interesting observation is, that the three tumors developing within and remaining confined to the fourth ventricle all produced hydro-

cephalus, while of the three developing within the fourth ventricle and extending to and over the surface of the brain, only one caused a moderate and one slight hydrocephalus.

Displacement of the cerebellum and distortion of the brain stem from extra-cerebellar tumors were found in the majority of cases studied. The direction of pressure, the unyielding character of the tentorium and the amount of the adhesions are factors in determining the extent and direction of displacement and distortion, and also an amount of atrophy of the proximal lobe.

The blood vessels within tumors are, as a rule, imperfectly formed, and in some rapidly growing tumors are but little more than irregular areas filled with blood, the walls being very thin and supported chiefly by tumor tissue, consequently hemorrhage of various grades of severity is relatively frequent.

Hemorrhage of sufficient size to increase the existing symptoms occurred within, and remained confined to the tumor in eight specimens. Of the eight tumors giving rise to hemorrhage, the greater number were glioma.

Hemorrhage of sufficient amount as to be the probable cause of death occurred eight times, in three instances at a distance from the tumor. One tumor of the cerebello-pontine angle was complicated by a hemorrhage into the frontal lobes of the same side, a gumma of the temporal lobe by a hemorrhage into the tegmentum of the pons, an endothelioma of the fourth ventricle by a large hemorrhage into the lateral lobe of the cerebellum.

In five instances hemorrhage evidently arising from within the tumor was of sufficient size to make its way to a considerable distance from the tumor. In one instance the later ventricle was filled with blood, and in two others subdural accumulation of blood was found. Of this latter group of eight, glioma was present twice. Hemorrhage remaining confined to the tumor is more common in glioma, and hemorrhage arising from the tumor and extending to a considerable distance, or occurring independently of the tumor, was more frequent in other tumors.

The histopathology of the tumors described in the article was studied in the laboratory of neuropathology of the University of Pennsylvania. There are six illustrations.

CHAS. E. ATWOOD (New York).

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